SUB-SECTION– E-24
FIRE PROTECTION SYSTEM

1.00.00	**FIRE DETECTION & PROTECTION SYSTEM**
1.01.00	HYDRANT SYSTEM: Shop Tests
1.01.01	**Hydrant Valve:**
	(a.) All valves shall be hydro tested for body and seat.
	(b.) Capacity test / flow test shall be done as per relevant standard.
1.01.02	Water Monitor, Hoses, Branch Pipes, Couplings and Nozzles:
	(a.) All tests including hydraulic test shall be done as per relevant Indian / International standard.
1.01.03	For Pumps, Diesel Engine, refer the requirements are indicated separately.
1.02.00	**HIGH / MEDIUM VELOCITY WATER SPRAY & SPRINKLER SYSTEM: Shop Tests**
1.02.01	For Pipes, Fittings, Valves and specialties, requirements are indicated separately.
1.02.02	Deluge Valves, Alarm Valves and Spray Sprinkler Nozzles
	(a.) All valves shall be hydro tested for body and seat.
	(b.) Performance test / functional test of 'Deluge Valves', 'Alarm Valves' and 'Spray Nozzles' shall be carried out.
1.02.03	**Detectors:** All 'Detectors' shall be tested as per relevant Indian / International Standards. Detectors shall also meet the requirements of UL / FM / LPC/VDS etc.
1.03.00	**HORIZONTAL CENTRIFUGAL PUMP:**
1.03.01	SHOP TESTS
	(a.) UT on Pump Shaft (>= 50mm dia) and MPI / DPT on Pump Shaft and Impeller shall be carried out.
	(b.) All rotating components of the pumps shall be statically and dynamically balanced as per IS: 21940 Gr. 6.3 or better.
	(c.) Hydraulic test shall be conducted on pump casing with water at 1.5 times the shut off pressure or twice the rated pressure whichever is higher for a minimum duration of 30 minutes.
	(d.) Performance test and Standard Running test:

(1.) All the pumps shall be tested in the manufacturer's works for capacity, efficiency, head and brake horsepower. Pump shall be given running test over the entire operating range covering the shut off head to the maximum flow. The duration of test shall be minimum one hour. A minimum of five readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pump shall be in accordance with stipulations oh Hydraulic Institute Standard (HIS) and / or as per applicable Indian Standard or equivalent. Tolerance of parameters shall be as per HIS.

(2.) The test shall be conducted at the rated speed preferably with the type tested contract drive motor being furnished. However, in case of any limitation test bed motor duly calibrated can also be used.

(3.) Noise and vibration shall be measured.

(4.) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level / vibration performance are observed during the shop test.

1.04.00 COMPRESSION IGNITION DIESEL ENGINE

1.04.01 Shop Tests:

(a.) All pressure parts shall be subjected to hydraulic pressure tests at 1.5 times the design pressure.

(b.) All Diesel engine shall be performance tests as per relevant IS / equivalent code.

1.04.02 **Performance Test :**

Performance test of diesel engine shall be carried out as per BS-5514 to determine the rated power and specific fuel consumption and governor's function. Performance test of engine in shop shall be done with actual job accessories for minimum four hours (three hours for full load and one hour for over load at 110% of

full load). All the engine parameters like RPM, inlet airs temp and pressure, water inlet and outlet temp. And pressure, lub. Oil pressure, fuel consumption, ambient condition shall be measured and recorded for every half an hour. No positive tolerance shall be allowed on the specific fuel consumption (contractor to specify in the offer.)

1.05.00 STORAGE VESSELS: Shop Test

1.05.01 **Atmospheric Tank**

(a.) All weld joints shall be DP Tested and complete tanks shall be water fill tested.

(b.) All atmospheric storage tanks fabricated and erected at site shall be subjected to all tests (Hydro, NDT, and Vacuum) according to design code as applicable.

1.06.00 PIPING, VALVE AND SPECIALITIES

1.06.01 **SHOP TESTS**

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

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

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

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

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

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

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

1.07.00 PORTABLE & MOBILE FIRE EXTINGUISHERS

1.07.01 SHOP TEST

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

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

1.08.00 EOT Crane

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

b) Electrical wire rope hoists shall be tested as per IS : 3938

c) Following NDT requirements shall be met:

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

(ii) DP at random on all weldments.

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

1.09.00 **SITE TESTS**:

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

(b.) Piping Protection:

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

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

(c.) Welding of Pipes:

(1.) ERW Black / rolled welded:

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

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

(2.) GI Pipes

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

SUB-SECTION– E-25
CONDENSATE POLISHING PLANT

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

LEGENDS: Applicable tests are identified by 'Y'.

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

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

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

Y^d :Dynamic Balancing per IS: 21940, Grade 6.3 minimum shall be conducted for rotating assy.

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

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

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

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

Y^6 : Blue Matching, Wear Travel for Gate Valves and reduced pressure test for check valves shall be conducted as per relevant standards.

Items / Components \ Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
10. Tanks/ Pressure Vessels	Y[a]	Y	Y[b]	Y	Y	Y[8]	Y		Y	Y[7]	Y[7] : Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall also be stress relieved as per the requirement of code. Y[8] : RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT. Y[9] :Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted. Y[10] :Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.
11. Rubber Lining	Y[a]				Y				Y	Y[9]	
12. Strainers	Y[a]	Y	Y[b]	Y	Y		Y		Y		
13. Pipe & Pipe Fittings	Y[a]	Y	Y		Y	Y[8]	Y		Y		
14. Agitators /Flash Mixer/ Flocculator	Y[a]	Y	Y[b]	Y	Y			Y		Y[10]	
15. Ventilation/Exhaust Fan	Y[a]		Y[b]	Y	Y			Y[11]	Y	Y[c], Y[d]	
16. Hoists & Cranes	Y[a]	Y	Y[b]	Y	Y	Y[8]		Y	Y		
17. Package/ Split AC	Y							Y	Y	Y[13]	

Test/Check / Items / Components	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
18. Resins / Activated Carbon									Y		Y^{11} :One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured. Y^{12} :Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring. Y^{13} : Electronic leak test for condenser & evaporator unit. Note: 1.The complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher after erection at site. 2. In case of items other than those identified above, the quality requirements shall be decided based on system design requirements.

SUB-SECTION– E-26
MILL REJECT HANDLING SYSTEM

CLAUSE NO.	QUALITY ASSURANCE
1.00.00	**PNEUMATIC CONVEYING SYSTEM**
1.01.00	**PIPING, VALVES, STRAINERS AND FITTINGS** (a) All pipes and fittings shall be tested as per applicable code. (b) All valves shall be hydraulically tested for body, seat and back seat (if applicable) as per relevant Standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. Valves shall be offered in unpainted condition only. (c) Functional checks of the valves for smooth opening and closing shall also be done. (d) Strainer body shall be hydraulically tested. One of each type and size of Strainer shall be tested for Pressure drop v/s flow rate, if not tested earlier.
1.02.00	**PRESSURE AND STORAGE VESSELS:** (a) Atmospheric Tank (i) All weld joints shall be DP tested and complete tanks shall be water fill tested. (ii) All atmospheric storage tanks fabricated and erected at site shall be subjected to all tests (Hydro, NDT and Vacuum) according to design code as applicable. (b) Pressure Vessel (1) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below: (i) 100% DPT on root run of butt weld, nozzle welds and finished fillet welds. (ii) 100% DPT on all finished butt welds (iii) 10% RT (covering all 'T'/cross joints) of butt welds (2) Butt Welds of dished ends shall be stress relieved and subjected to 100% RT. (3) Each finished vessels shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.
1.03.00	**PACKAGE AIR COMPRESSOR** In addition to Hydraulic tests of pressure parts, performance test of the compressor shall be done for FAD, pressure, power consumption, as per relevant code. Noise and vibration shall also be measure.
1.04.00	**BAG FILTERS:**
1.04.01	Leakage test shall be carried out for casing and other pressure parts
1.04.02	Pulsing and sequential test on bag filter cages shall be done.
1.05.00	**MONORAIL HOIST/CHAIN PULLEY BLOCKS:**
1.05.01	Chain pulley blocks shall be tested as per IS:3832
1.05.02	UT & MPI/DPT shall be done on gear blank, pinion shaft, axles.
1.05.03	Proof Load Test on hooks shall be carried out followed by DPT.
1.05.04	100% Radiography on weld joints under tension and 10% radiography on compression butt joints followed by 100% DPT shall be done for rope drum, girder, end carriage etc.
1.05.05	Complete hoists shall be tested for load and overload test as per IS:3938
1.06.00	**VENTILATION SYSTEM:**
1.06.01	Shop Run Test for all Centrifugal Fans to check noise, temp. rise & vibration.
1.06.02	Performance test on one fan of each type for capacity, pressure, efficiency and power consumption.

SUB-SECTION– E-27
FUEL OIL HANDLING SYSTEM

TANKS AND VESSELS

1. Material Tests (Chemical Analysis, Mechanical Tests & other tests) as per applicable material standard of all components (plates, forgings etc)

2. Only Qualified welders as per approved WPS and PQR shall be deployed for fabrication of tanks.

3. Dimensional checks, during in-process and final inspection, shall be carried out for alignments, circularity, verticality, orientation of connections, slope of bottom plate etc.

4. NDT on weld joints shall be done as per relevant / applicable standard. However, minimum requirement of NDT, as given below, shall be complied:

a. 100% DPT on root run (butt welds / back-gouged welds).

b. 100% DPT on all finished welds.

c. 10% RT on butt-welded seams (which shall cover all 'T' / Cross-joints) as per design code / Standard.

5. All tanks shall be subjected to hydraulic test to 150 % of the Design pressure for a duration of 30 minutes. Other tests, (as per relevant design standard), given below shall be applicable as per relevant code/standard.:

a. Vacuum test for bottom plate seam testing and annular plate.

b. Air / vacuum test for roof testing.

FUEL OIL PUMPS/DRAIN OIL PUMP/WATER PUMP

1. Material Tests (Chemical Analysis, Mechanical Tests & other tests) as per applicable material standard of all components (plates, forgings etc)

2. All forged / rolled bars (for pump rotors / screws) shall be subjected to Ultrasonic Test (for diameter>= 40mm) at proof machine condition and DPT / MPI after finish machining.

3. Rotating parts i.e. Screws / Rotors, Impellers (other than single screw pump) shall be statically and dynamically balanced as per requirements of code ISO: 1940 Gr. 6.3/IS 21940 or better.

4. The machined surfaces of castings shall be subjected to DP Test.

5. Pump casing shall be hydraulically tested at a pressure 150% of specified shut off head or 2 times working pressure (whichever is higher) for leak tightness for a duration of 30 minutes.

6. All pumps shall be performance tested as per relevant / applicable code/standard.

PIPING, VALVES, STRAINERS AND FITTINGS:

FOR PIPES, VALVES, FITTINGS AND SPECIALITIES REFER QA CHAPTER OF LP PIPING.

INSULATION

1. Rockwool/Mineral Wool/Glass Wool shall be tested as per relevant standard. However, Thermal Conductivity type test shall be carried out minimum once in a year as per relevant code/standard.

2. Lagging/Cladding shall be tested as per relevant Standard to meet data sheet requirements.

MONORAIL HOISTS

FOR HOISTS REFER QA CHAPTER "EOT CRANES AND HOISTS",

FLEX HOSES

Tests such as Adhesion property before and after aging and swelling, tensile, elongation at break for rubber and vacuum test, pressure test, burst/proof pressure test, dimension of finished hose shall be carried out as per relevant code/standard.

SUB-SECTION– E-28
GENERATOR AND AUXILARIES

GENERATORS & AUXILIARIES.

PROCESS CHECK FOR STATIC PARTS GENERATOR / EXCITOR													
TESTS / ITEM/ COMPONENTS /PROCESS	Visual & dimension	Chem. Prop. (Raw material)	Heat treatment	Mech.Prop. (Raw material as applicable)	Impact. (Raw material)	Hydraulic test	Pneumatic test	RT/UT (10% for butt weld)	MPI/DPT (All welds of trunnion & base plate, sample on other)	Relative permeability *	Ferrite content	DIN 43760, IS 2848,7358	DIN 48124
Sheet and Fabrication -END shield	Y	Y	Y	Y	Y	Y1	Y1	Y	Y				
-Stator casing	Y	Y	Y	Y	Y	Y1	Y1	Y	Y				
-Bushing boxes	Y	Y	Y	Y	Y	Y1	Y1	Y	Y				
-Terminal plates	Y	Y	Y	Y	Y	Y1	Y1		Y				
-Manhole and covers	Y	Y	Y	Y	Y	Y1	Y1		Y				
-Trunnions	Y	Y	Y	Y	Y			Y	Y				
Core bar	Y	Y		Y									
Press ring	Y	Y		Y					Y				
Core bolt (insulated)	Y	Y		Y				Y	Y				
Gaskets	Y			Y									
Bearing and Hydrogen Seals	Y	Y		Y				Y2					
Terminal Bushing													Y
RTD/ Thermocouple												Y	
Additional checks for -Nonmagnetic Components										Y			
-Nonmagnetic Components welding											Y		
Y-Test applicable, Y1-For Hydrogen cooled machine, Y2-UT on Babbitt for bearing, * - As per OEM standard practice.													

Note:

1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2) All generators shall be assembled at works and shall be tested to verify/ensure design and workman ship in accordance with IEC-34, VDE 0530, IEEE 115, IEEE 43. The manufacturer shall submit detailed test procedure which clearly specify test set up, instruments to be used, acceptance norms (wherever applicable) recording of different parameter, interval of recording, precautions etc.
3) Cooler, control panel and other auxiliaries (as applicable) to be suitably tested as per tests covered in the specification.
4) Test requirements of primary water system, seal oil system and Hydrogen cooling system shall be as per tests specified for similar items under respective tables covered in this section.

GENERATORS & AUXILIARIES

PROCESS CHECK FOR CORE GENERATOR/EXCITOR

TESTS / ITEM/ COMPONENTS / PROCESS	Specific loss before and after ageing		Anisotropy of losses	Stacking factor	Burr level	chem., elect., viscosity cure time, solid content, dielectric properties	Dimension & surface (uniformity of varnish coat)	Spot weld check
Core lamination	Y	Y	Y	Y			Y	
After punching Insulated core Laminations					Y		Y	
Check for varnish						Y		
Ventilation Stamping								Y
Core assembly							Y	

TESTS / **ITEM/ COMPONENTS / PROCESS**	Process check including Heating & pressure application	Insulation test of insulated core tension bolt & core bar	Functional check of ventilation ducts	Hot spot at rated flux density by infra-red camera & ELCID *	Location of temp. detectors	Iron loss at rated flux density
CORE assembly (additional Checks for Generator)	Y	Y	Y	Y	Y	Y

Y-Test applicable

*** In case of any constraint of manufacturer to carry out the test at rated flux, testing at reduced flux as per manufacturer guidelines to be proposed to Owner for review & approval.**

GENERATORS & AUXILIARIES

PROCESS CHECK FOR CORE GENERATOR/EXCITOR

TESTS \ ITEM/ COMPONENTS / PROCESS	Winding copper and connecting bus bars	Insulated conductor	Insulation material	Manufacturing Winding bar & phase bar	Winding laying	Water supply hoses	Winding support ring	Connection between bars	Wound stator
Support arrangement					Y	Y			
Type test reports for similar type of bars for heating cycle test, thermal stability test @				Y					
Slot wedge tightness & radial movement									Y
Thermal shock test Baroscopic Examination of brazed water box				Y1					
Inter strand Insulation test				Y				Y2	
Dielectric test at elevated and room temp.		Y							
Vibration fatigue *						Y			
Magnetic permeability of metallic parts						Y			
Reactance of stator winding									Y
Corona protection resistance				Y					
Partial Discharge test				Y#					
Tan delta and delta, tan delta Up to 1.2 un				Y					Y
Check on RTD + location winding					Y				
Helium leak test & PR. test				Y		Y			
Flow test				Y1					Y1
Process check				Y	Y				
X-Ray of Water box				Y1					
Brazing procedure				Y				Y	
Physical prop.			Y				Y		
Electric test			Y	Y	Y				
Dimension/visual		Y	Y	Y	Y	Y	Y		
Dielectric test		Y		Y	Y	Y			
Flexibility of bending temp.		Y							
Insulation adhesion		Y							
Eddy current & pr. Test	Y1								
Metallography prop.	Y								
Resistivity/Resistance	Y								
Chem. prop (sample)	Y		Y			Y	Y		
Mech. prop (sample)	Y		Y			Y			

Y - Test Applicable.
Y1- Applicable for hollow conductor.
Y2: Not applicable for connection between bars through contact sleeve (lug).
Y#: OEM practice shall be followed.
* As per manufacturer established practice.
@: Type test reports for similar type of bars for heating cycle test, thermal stability test, and voltage endurance test manufactured from same works from which bars are to be sourced is acceptable if conducted within 5 years of bid opening.

GENERATORS & AUXILIARIES

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)

TESTS / ITEM/ COMPONENTS / PROCESS	Rep. sample tensile stress	Rep. sample 0.2 limit	Rep. sample elongation	Hardness on Sample	Impact check on sample	Rep. sample Chem. Prop.	NDTT, FATT (as applicable)	Process check including heat treatment (as applicable)	Ultrasonic test/RT (at suppliers work and after preliminary machining)	Flux carrying capacity/ Magnetic prop	Flux carrying capacity / Magnetic prop *	Boroscopic Examination
Rotor forging & slip ring shaft	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rotor end retaining ring, locking ring & Slip ring forgings, diode wheel	Y	Y	Y		Y	Y		Y	Y			
Rotor wedges, damper Wedges.	Y		Y			Y		Y	Y			
Rotor winding copper CC-bolts & D-leads	Y		Y			Y		Y				
Rotor slot boxes/ insulating material						Y						
Coil manufacture												
Rotor winding								Y				
Winding connection studs & assembly												
Complete rotor								Y				
Test on completed rotor at various speed up to rated speed												
Test on completed rotor before & after over speed												
Fan hubs/blades						Y		Y	Y			
GENERATOR assembly												
Diode wheel Assembly												
Permanent magnet					Y						Y	
EXCITER assembly												

Y- Test Applicable

* Not applicable for slip ring shaft of SEE.

GENERATORS & AUXILIARIES

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)											
TESTS / ITEM/ COMPONENTS /PROCESS	MPI/DP/NDT test	Visual/Dimension/Cleanliness	Adhesion, thickness of Coat on silver plating If applicable	Electrical conductivity and Oxygen content	Mech. test on sample	Electrical test (Σ)	Resistance measurement	Vent hole blockage	Helium leak test for Hydrogen cooled M/C	Inter turn test	Dielectric test
Rotor forging & slip ring shaft	Y	Y									
Rotor end retaining ring & cover, locking ring & Slip ring forgings, diode wheel	Y		Y								
Rotor winding copper, rotor wedges, damper Wedges, CC-bolts & D-leads	Y		Y	Y1		Y					
Rotor slot boxes/ insulating material					Y	Y					
Coil manufacture		Y									
Rotor winding	Y	Y				Y		Y		Y	Y
Winding connection studs & Assembly	Y				Y				Y		Y
Complete rotor							Y				Y
Test on completed rotor at various speed up to rated speed										Y	Y
Test on completed rotor before & after overspeed		Y					Y			Y	Y
Fan hubs/blades	Y	Y									
GENERATOR assembly		Y									
Diode wheel Assembly		Y									
Permanent magnet		Y			Y						
EXCITOR assembly		Y									

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)

ITEM/ COMPONENTS /PROCESS \ TESTS	Insulation Resistance	PI	Radial run out/alignment	Impedance measurement/ RSO (repetitive surge oscillograph)	Dynamic balancing ISO 5406, 2372, 1940	Over speed test (120%) for 2 minutes	Axial run out	Metallography examination *	Torque on joint bolts	Fitting and locking of Balancing weights	Brazer and brazing procedure
Rotor forging & slip ring shaft								Y			
Rotor end retaining ring & cover, locking ring & Slip ring forgings, diode wheel											
CC-bolts									Y		
Rotor slot boxes/ insulating material											
Coil manufacture											Y
Rotor winding											Y
Winding connection studs & assembly	Y										
Complete rotor	Y		Y	Y	Y	Y			Y		
Test on completed rotor at various speed up to rated speed				Y							
Test on completed rotor before & after overspeed	Y		Y	Y							
Fan hubs/blades										Y	
GENERATOR assembly	Y	Y	Y				Y		Y	Y	Y
Diode wheel Assembly			Y				Y		Y	Y	
Permanent magnet											
EXCITOR assembly			Y						Y	Y	

Y-Test applicable.
* - As per OEM standard practice.

GENERATORS & AUXILIARIES

ADDITIONAL CHECKS FOR EXCITOR

ITEM/ COMPONENTS /PROCESS \ TESTS	Routine Test as per applicable std	As per IEC-76 / Applicable std	Pole parallelism & polarity	Mech. chem. & Magnetic prop. (As applicable)	Functional check	Insulation resistance	IEEE/ANSI-C37.18 Or IEC 60947-2	As per applicable standards	As per specification	Dimensional and visual
Fuse diode & filter Circuit	Y									Y
Aux. Transformer (if applicable)		Y								
Carbon brush holder & housing				Y	Y				Y	Y
Cable									Y	
PMG & Exciter stator			Y	Y		Y				
Bandaging wire				Y						
Field discharge resistor					Y					
Bearing, exciter armature field, axis coil, RTD						Y				
Excitation Transformer		Y								
Thyristors									Y	
Field breaker					Y		Y			
Bus duct AC/DC								Y		
Voltage Regulator									Y	
Carbon brush				Y	Y				Y	Y

Y - Test applicable

GENERATOR AND AUXILIARIES

FINAL ACCEPTANCE TEST GENERATOR/EXCITOR

TESTS / ITEM/ COMPONENTS /PROCESS	Works run test on generator to be conducted on first unit of each rating per contract to establish the performance characteristics / designated attributes	On total winding/phase at interval of 0.2 U_n for generator	Condition after dismantling (after works run test)	Works test on brush less exciter	PMG works test	Full load for PMG & convertor assembly	Convertor assembly for SEE	Static excitation system
Partial Discharge	Y							
Visual and dimension	Y							
Vibration Measurement	Y							
Winding Overhang			Y					
Seal Ring. Liners			Y					
Bearing oil catcher			Y					
Rotor journal			Y					
Tan delta, delta tan delta	Y	Y						
Capacitance measurement	Y	Y						
RTD, BTD Check	Y							
HV test (except electronic circuit)	Y			Y	Y		Y	Y
Shaft voltage	Y							
Phase seq. voltage	Y				Y			
Polarization index	Y							
Insulation resistance	Y			Y	Y		Y	Y
Efficiency By separation of Losses	Y							
Steady state reactance's	Y							
Record Aux. parameters	Y							
SCC	Y							
OCC	Y			Y	Y			
Voltage regulation					Y			
Function check							Y	Y
Heat run test	Y			Y	Y	Y		
Rotor impedance at various speeds in steps of 200 rpm	Y							
Resistance measurement	Y			Y	Y			
Gas tightness for Hydrogen cooled M/C	Y							

Y – Test Applicable

FINAL ACCEPTANCE TEST GENERATOR/EXCITOR

TESTS / ITEM/ COMPONENTS /PROCESS	Seal rings, liners	Winding Overhang	Vibration measurement	No load	Load characteristics	axis	Ripple content	As per specification	Visual & dimension	Partial discharge
Works test on brush less exciter			Y	Y	Y	Y			Y	
PMG works test				Y	Y					
Static excitation system							Y	Y	Y	

Y - Test Applicable

SUB-SECTION– E-29
CABLING, EARTHING & LIGHTING PROTECTION

CABLING, EARTHING, LIGHTNING PROTECTION

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanize Test (If Applicable)	Functional	Bought out items/Bill of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per NTPC Specification
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y		Y	Y	Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Cable glands (BS-6121)	Y													Y
Cable lug	Y													Y
Lighting wire (IS-694)	Y											Y		
Flexible conduits	Y											Y		Y
Conduits (Galvanize & Epoxy) IS-9537 & IS-2629, 2633, 6745	Y		Y						Y			Y		Y
RCC Hume Pipe (IS-458)												Y		
Cable termination & straight through joint (IS 13573)	Y											Y		Y
Cable Trays, bends, tees, crosses, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y		Y			Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire (IS-280)	Y											Y		
Fire Sealing System (BS –476)												Y	Y	Y

Note:

1) This is an indicative list of tests /checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2) * Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the NTPC technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & crosses.

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

SUB-SECTION– E-30
DC SYSTEM

DC SYSTEM

LEAD ACID BATTERY

ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY / ATTRIBUTES / CHARACTERISTICS	Dimensions & Finish	Conformance to relevant part drg. & Manufacturer's standards	Chemical composition	Lead Coating Thickness (min. 25 microns, IS: 6848 App.F) & Adhesion Check	Conformance to CPWD Spec. for Teak Wood	Paint Process checks, Paint Shade, Thickness, Adhesion & Finish	Constructional requirements as per NTPC Spec.	Routine & acceptance tests as per relevant standard
Container & Lids (IS: 1146)	Y	Y						
Vent Plugs	Y	Y						
Sealing Compound (IS: 3116)		Y	Y					
Positive & Negative Plates		Y	Y					
Separators (IS: 6071)	Y	Y						
Electrolyte (Water / Sulphuric Acid) (IS: 1069 / 266)		Y	Y					
Inter-cell Connectors & Fasteners	Y	Y		Y				
Battery Stand	Y	Y			Y	Y		
Cell Insulators	Y	Y						
Stack Assembly	Y	Y						
Lead Acid Battery (IS: 1652)	Y						Y	Y

Note:
This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

Ni- Cd BATTERY								
ATTRIBUTES / CHARACTERISTICS ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY	Dimensions & Finish	Impact Strength	Conformance to relevant part drg. & Manufacturer's standards	Resistance to Alkali	Chemical composition	Nickel Plating thickness	Paint Shade, Thickness, Adhesion & Finish	Routine & acceptance tests as per relevant standard
Container & Lids	Y	Y	Y	Y				
Vent Plugs	Y		Y	Y				
Perforated Steel Strips	Y		Y	Y		Y		
Active Material for Positive & Negative Plates			Y		Y			
Separators	Y		Y	Y				
Electrolyte			Y		Y			
Inter-cell Connectors & Fasteners	Y		Y	Y		Y		
Battery Stand	Y			Y			Y	
Cell Insulators	Y		Y	Y				
Stack Assembly	Y		Y					
Ni-Cd Battery (IS: 10918)	Y							Y

Notes:

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

BATTERY CHARGER

ITEMS / COMPONENTS / SUB- ASSEMBLY / ATTRIBUTES / CHARACTERISTICS	Make, Model, Type, Rating & Finish	Verification of Routine test reports as per relevant IS	Sheet Steel Pretreatment & Painting process	Conform to relevant Standard & NTPC spec	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per NTPC approved	Temperature Rise Test	Ripple Content Test, Load Limiter & AVR Operation Test	Dynamic Response Test	Operational & Functional Checks	HV & IR Test	Burn-In Test at 50^C for 48 hrs. in energized condition	Alternating current measurement test	Degree of Protection Test as per NTCP Spec.
Rectifier Transformer and Reactors IS: 4540, 2026)	Y	Y		Y			Y				Y			
Electronic Components including Potentiometer (Vernier Type)	Y			Y		Y								
Electronic Cards	Y			Y								Y		
PCB & racks for electronic cards	Y					Y								
Control & Selector Switches (IS: 6875)	Y			Y						Y				
Indicating Meters (IS: 1248)	Y			Y						Y				
Indicating Lamps (IS: 13947)	Y			Y						Y				
Air Break Switches / Fuses (IS: 13947 / 13703)	Y			Y						Y				
Control Terminal Blocks (IS: 13947)	Y			Y										
Control Transformer (IS: 12021)	Y			Y						Y				
Push Buttons (IS: 4794)	Y			Y						Y				
MCB (IS: 8828)	Y			Y						Y				
PVC insulated Copper control wires (IS: 694)	Y			Y										
Sheet Steel (IS: 513)	Y		Y	Y										
Synthetic Rubber Gaskets	Y			Y										
Annunciator	Y									Y		Y		
Battery Charger	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Notes:

1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

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

BATTERY CHARGER
(of capacity up to 24 V / 48 V, 150 A DC)

ATTRIBUTES / CHARACTERISTICS / ITEMS / COMPONENTS / SUB- ASSEMBLY	Make, Model, Type, Rating	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per approved drgs	Ripple Content Test, Load Limiter operation & AVR Operation Test	Operational & Functional Checks of aux. Devices like annunciator, switches, indicators etc.	HV & IR Test	Burn-In Test	Dynamic response test	AC input current measurement test	Temperature rise test
Battery Charger	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note:

1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

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

DC HEALTH MONITORING SYSTEM

ATTRIBUTES / CHARACTERISTICS / ITEMS / COMPONENTS / SUB- ASSEMBLY	Make, Model, Type, Rating & Finish	Verification of Routine test reports as per relevant IS	Sheet Steel Pretreatment & Painting process checks	Conform to relevant Standard & NTPC spec	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per NTPC approved drgs & specification	Operational & Functional Checks	HV & IR Test	Burn-In Test at 50^C for 48 hrs in 5energized condition	Degree of Protection Test as per NTCP Spec.
Enclosure	Y		Y	Y	Y					Y
Synthetic Rubber Gaskets	Y			Y						
Control & Selector Switches, Indicating Meters, Indicating Lamps	Y			Y			Y			
Control Terminal Blocks, Push Buttons, MCB	Y			Y			Y			
MCB	Y			Y			Y			
PVC insulated Copper control / signal cables	Y	Y		Y						
Transducers / detectors	Y	Y		Y			Y			
PCB & racks for electronic cards	Y									
Electronic Cards	Y						Y		Y	
Microprocessor Based Controller	Y						Y		Y	
SCADA	Y						Y			
Software	Y						Y			
DC Health Monitoring System	Y			Y	Y	Y	Y	Y	Y	Y

Notes:

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

DC HEALTH MONITORING SYSTEM

ITEMS / COMPONENTS / SUB- ASSEMBLY / ATTRIBUTES / CHARACTERISTICS	Make, Model, Type, Rating & Finish	Verification of Routine test reports as per relevant IS	Sheet Steel Pretreatment & Painting process checks	Conform to relevant Standard & NTPC spec	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per NTPC approved drgs & specification	Operational & Functional Checks	HV & IR Test	Burn-In Test at 50^C for 48 hrs in 6energized condition	Degree of Protection Test as per NTCP Spec.
Enclosure	Y		Y	Y	Y					Y
Synthetic Rubber Gaskets	Y			Y						
Control & Selector Switches, Indicating Meters, Indicating Lamps	Y			Y			Y			
Control Terminal Blocks, Push Buttons, MCB	Y			Y			Y			
MCB	Y			Y			Y			
PVC insulated Copper control / signal cables	Y	Y		Y						
Transducers / detectors	Y	Y		Y			Y			
PCB & racks for electronic cards	Y									
Electronic Cards	Y						Y		Y	
Microprocessor Based Controller	Y						Y		Y	
SCADA	Y						Y			
Software	Y						Y			
DC Health Monitoring System	Y			Y	Y	Y	Y	Y	Y	Y

Notes:

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

SUB-SECTION– E-31
ESP

ESP ELECTRICAL PORTION

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	Make / Type / Rating etc.	Final Inspection as per ISS / IEC /BS	Remarks
TR Set	Y	Y		Refer table for Transformer Rectifier Set for ESP
ESP Insulator (IEC 168 / 273, IS 2544)	Y	Y	Y	ESP Insulators shall be additionally subjected to high temperature test on sample basis as per mutually agreed upon procedure.
Electrostatic Precipitation Management System	Y	Y		Refer table for Annunciation, control, PLC Panel
Microprocessor based Rapper Controller	Y	Y		Refer table for Annunciation, control, PLC Panel
Disconnecting switch (IS 13947)	Y	Y	Y	
Heaters (IS 4159 / BS 6351)	Y	Y	Y	

Note:

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

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

TRANSFORMER RECTIFIER SET FOR ESP

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	Dimensional & Physical	Make/Type/Rating	Mech. / Chem. Properties	Electrical	Electronics	Welding	NDT	Pretreatment 7 tank	Painting,	All tests as per IS2026	All tests as per IEC-146
Thyristor	Y	Y	Y			Y						Y
Contactor	Y	Y	Y		Y							
Switch Fuse Unit	Y	Y	Y		Y							
HRC Fuse	Y	Y	Y		Y							
Current Transformer	Y	Y	Y		Y							
Over Voltage Protector	Y	Y	Y		Y							
Measuring Instruments	Y	Y	Y		Y							
Control Transformer	Y	Y	Y		Y							
Bushings	Y	Y	Y		Y							
Dial Thermometer	Y	Y	Y		Y							
Resistor wire wound	Y	Y	Y		Y							
Sudden Pressure Relay	Y	Y	Y		Y							
PVC Insulated Copper wire (ISI Marked)	Y	Y	Y		Y							
Terminal Block	Y	Y	Y		Y							
Gasket	Y	Y	Y	Y								
Electrolytic Copper	Y	Y	Y	Y								
Capacitor, Resistor	Y	Y	Y	Y	Y	Y						
PCB	Y	Y	Y		Y							
Insulated Conductor	Y	Y	Y	Y	Y							
Laminations	Y	Y	Y	Y	Y							
Press Board, Paper	Y		Y	Y	Y							
Insulating Oil (Silicon)	Y	Y	Y	Y	Y							
Radiator	Y	Y	Y	Y				Y				
Transformer Tank	Y	Y	Y	Y			Y	Y				
Panel Fabrication	Y	Y	Y	Y			Y		Y	Y		
Electronic Cards	Y	Y	Y		Y	Y						
Linear Reactor, Choke	Y	Y	Y	Y	Y							
Transformer Assembly	Y	Y		Y	Y						Y	
Control Panel	Y	Y	Y	Y	Y	Y				Y		
HV, TR Set	Y	Y	Y		Y	Y				Y	Y	
EPC Controller (Separate QAP	Y	Y			Y	Y						

Note:

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

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

ANNUNCIATION, CONTROL, PLC PANEL

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	GA, BOM, Lay Out of components	Dimensions	Paint Shade/ Thickness/ Adhesion	Component Rating/ Make / Type	Wiring	IR & HV	Review of TC for instruments	Accessibility of TBS/ Devices	Illumination	Functional Check for Control Element, Annunciation	Test as per IEC 1131 *	Routine & acceptance Tests as per IS 8623
Annunciation, Control, PLC Panel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note:

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

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

- *Applicable for PLC

SUB-SECTION– E-32
GENERATOR BUS DUCT & NG EQPMTS

GENERATOR BUS DUCT & NG EQUIPMENT

Attributes / Characteristics / Items/Components Sub Systems	Visual & Dimensional Checks	Electrical / Mechanical / Chemical Properties	WPS & PQR	NDT (DP / UT / RT/ MPI)	Painting/ Silver Plating Quality, Thickness & Adhesion Test	Galvanising Test as per IS: 2629 / 2633 / IS: 6745	Electrical clearance & Creepage distance	Functional/Operational check	Embossing of logo/Batch number	Make / Type Rating / Model / TC / General Physical Inspection	Trial Assembly at works.	Routine Test as per relevant standard / NTPC specs	Test as per IEEE-32 for NGR	IR Measurement before and after HV Test
Enclosure / Cubicle	Y	Y	Y	Y	Y									
Bus bar Conductor/Flexible Connector & Disconnector Link	Y	Y	Y	Y										
Epoxy Seal-off Bushing, Post/Support Epoxy/Porcelain Insulator as per IS:5621 & 2544	Y	Y							Y			Y		
Galvanized Steel Structure & Plate	Y					Y								
Welding on Enclosure & Conductor joint	Y		Y	Y										
Silver plated connections					Y									
Elastomer Spring Head, Panel Mounted Items & NG Cubicle	Y							Y		Y		Y		
Bus Bar Pressurization System	Y							Y				Y		
Complete Bus Duct & Cubicles	Y				Y		Y				Y	Y		Y
Complete NGR (IEEE-32)	Y				Y			Y				Y	Y	Y
Gasket, Silica gel Breather ,CT, VT, Surge Capacitor & Arrestor, NGT	Y									Y		Y		

Note :

1. **This is an indicative list of tests / checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure along with relevant supporting documents during QP finalization for all the items.**
2. All major Bought Out Items will be subject to NTPC approval.
3. Y-Test applicable

SUB-SECTION– E-33
400KV SHUNT REACTOR

SHUNT REACTOR

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS SUB SYSTEMS	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Functional check	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	WPS & PQR	Routine Test as per relevant standard/NTPC specs.	Vacuum & Pressure Test
Tank	Y	Y					Y					Y		
H.V. & L.V. Cable Box / Flange throat	Y	Y												
Conservator / Radiator / Cooler / Pipes	Y	Y												
Copper Conductor (IS:191)	Y	Y	Y		Y									
Insulating Material	Y	Y	Y	Y	Y	Y								
CRGO Lamination & Built Core	Y	Y	Y		Y	Y								
Porcelain Bushing / Insulator (IS:2544 / 5621)	Y	Y	Y								Y		Y	
RIP/OIP Bushing (IS 12676, IS 2099, IS 3347& IEC 60137)	Y	Y	Y								Y		Y	
Gasket (IS 2712)	Y	Y			Y	Y		Y						
Air Cell	Y													Y
Transformer Oil			Y		Y								Y	
Core Coil Assembly & Pre-tanking	Y									Y				
Marshalling Box	Y	Y					Y		Y		Y		Y	
WTI, OTI, MOG, PRD, Thermistor, Breather, Terminal Connector, Fan & Pumps with Drives, Valves, Bucholz Relay									Y		Y			
Welding (ASME Sect-IX)							Y					Y		

SHUNT REACTOR

ATTRIBUTE/ CHARACTERISTICS ITEMS/COMPONENTS SUB SYSTEMS	Oil Leakage Test	Jacking test followed by DP Test on load bearing Member	DGA of Oil for main tank	Measurement of capacitance and tan delta	Di-electric Tests	Switching impulse test on line terminal	Nitrogen / Dry Air Dew Point Measurement before final packing on transformer at receipt at site.	Lighting Impulse Test on all phases	Vibration and stress measurement test	Routine Test as per relevant standard/NTPC Spec.	Paint Shade, Thickness, Adhesion and finish.
Complete Shunt Reactor (IS:5553 -I / IEC: 289 & 76)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note:

1) This is an indicative list of test/checks. The manufacture is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents during QP finalization for all items.

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

Y-Test applicable

SUB-SECTION– E-34
POWER TRANSFORMER (GT, UNIT & STATION TRANSFORMER)

GENERATOR TRANSFORMER/ INTERCONNECTING TRANSFORMER/ INTER BUS TRANSFORMER/UNIT TRANSFORMER/STATION TRANSFORMER

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS SUB SYSTEMS	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT (DPT / RT / UT)	Functional check	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	Isolation test on core/clamp/tank	WPS & PQR	Routine Test as per relevant standard / NTPC Specs	Vacuum & Pressure Test
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y				Y		Y		
Conservator / Radiator / Cooler / Pipes	Y	Y					Y				Y				
Copper Conductor (IS:191)	Y	Y	Y		Y										
Insulating Material	Y	Y	Y	Y	Y	Y									
CRGO Lamination & Built Core	Y	Y	Y		Y	Y					Y				
Porcelain Bushing / Insulator (IS: 2544 / 5621)	Y	Y												Y	
RIP - OIP Bushing (IS 12676, IEC 60137)	Y	Y	Y								Y			Y	
Gasket (IS 2712)	Y	Y			Y	Y			Y						
Air Cell	Y														Y
Transformer Oil									Y					Y	
On Load / Off-Circuit Tap Changer (IEC :214)	Y	Y	Y											Y	Y
Core Coil Assembly & Pre-tanking	Y									Y		Y			
Marshalling Box	Y							Y						Y	
WTI, OTI, MOG, Bucholz Relay, PRD, Thermistor, Breather, Terminal Connector, Bushing CT, Fan & Pumps with Drives, Valves								Y			Y				
Testing & Maintenance equipment											Y				
Welding (ASME Sect-IX)							Y						Y		

GENERATOR TRANSFORMER/ INTERCONNECTING TRANSFORMER/ INTER BUS TRANSFORMER/UNIT TRANSFORMER/STATION TRANSFORMER								
ATTRIBUTE/ CHARACTERISTICS **ITEMS/COMPONENTS SUB SYSTEMS**	Oil Leakage Test	Jacking test followed by DP Test on load bearing Member	DGA of Oil for main tank and OLTC Chamber	Measurement of capacitance and tan delta	Di-Electric tests	Routine Test as per relevant standard / NTPC Specs	Nitrogen / Dry Air Dew Point Measurement before final packing on transformer at receipt at site.	Paint Shade Thickness and Adhesion & finish.
Complete Transformer (IS: 2026 / IEC: 60076)	Y	Y	Y	Y	Y	Y	Y	Y

Note:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure along with relevant supporting documents during QP finalization for all the items.
2. All major Bought Out Items will be subject to NTPC approval.
3. Read Mechanical strength as mechanical endurance for OLTC/OCTC
4. Y-Test applicable

SUB-SECTION– E-35
LT INDOOR TRANSFORMER

LT INDOOR TRANSFORMER

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

Notes:

1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalization for all items.
2) All major Bought Out Items will be subject to NTPC approval.

SUB-SECTION– E-36
AUXILIARY TRANSFORMER

AUXILIARY / LT TRANSFORMER

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

Note:

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

SUB-SECTION– E-37
H.T. CABLE

MV (3.3 KV / 6.6. KV / 11 KV / 33 KV) CABLES

ATTRIBUTES/ CHARACTERISTICS / ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test (as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability on outer	Metallic (Cu) Screening (If applicable)	Anti-termite coating on wooden drums	Constructional requirements feature as per specification	Routine & Acceptance Test as	FRLS Test
Aluminum (IEC 60228)	Y	Y	Y	Y		Y											
Semiconducting Compound	Y		Y			Y											
XLPE Compound (IEC 60502-2 (2005))	Y		Y			Y					Y						
FRLS PVC Compound (IEC-60754 Part-1)	Y		Y								Y	Y					Y
Triple Extrusion & curing /Manufacturing of Core		Y			Y		Y										
Copper Tape	Y	Y	Y			Y											
Polyester tape	Y	Y															
Core Laying								Y									
Armor wire/strip	Y	Y	Y														
Copper tapping	Y	Y											Y				
Inner sheath	Y	Y															
Armoring		Y							Y								
Outer Sheathing		Y								Y							
Power Cable (Finished)								Y	Y	Y	Y	Y			Y	Y	Y
Wooden drum (relevant standard) /Steel Drum		Y												Y	Y		

Notes:

This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

Make of all major Bought out items will be subject to Owner's approval.

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all types & sizes.**	
1)	Conductor Resistance test	
2)	High voltage test	
3)	Partial discharge test (**for Screened cables only)**	
ACCEPTANCE TESTS	**Following Acceptance tests shall be carried out on each size of each type (voltage rating) of cables, in the offered lot.**	
A) For Conductor (as per sampling plan mentioned in IEC 60502-2 (2005))		
	1)	Annealing test (Copper)
	2)	Tensile Test (Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
B) For copper tape / Wires (as per sampling plan mentioned in IEC 60502-2 (2005))		
	1)	Measurement of Dimensions
	2)	Conductivity check
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IEC 60502-2 (2005))		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test for Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects

C) For XLPE insulation & PVC Sheath (as per sampling plan mentioned in IEC 60502-2 (2005))		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")
	3)	Hot set test (For XLPE insulation)
D) Ageing test:		
If the compound manufacturer is carrying out Ageing test, test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer will carry out ageing test & the test report will be reviewed by owner (quantum of ageing test sample shall be one sample /batch)		
(a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre: - Routine Test of manufacturer internal test reports are to be verified by owner and Main Contractor at the time of final inspection. Owner and Main Contractor will also witness routine tests on cables on 10% sample basis. (b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre: - Routine Test of manufacturer internal test reports are to be verified by Owner at the time of final inspection. Owner will witness routine tests on cables for the first order on 10% sample basis and Main Contractor will witness routine tests on cables for the first order on 100% basis.		
1. For Smoke Density rating test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 2. For Acid Gas Generation test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 3. For Oxygen Index test: if the test result without conditioning is within (+)7% of the minimum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 4. In case the test results without conditioning do not meet the maximum/minimum specified value, the manufacturer may exercise the option of retesting the samples after conditioning as per standard.		
E) Following tests will be carried out on completed cables as per relevant standard on each size of each type		
	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test
	3)	Partial discharge test (for Screened cables only)
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)		
	1)	Thermal stability test on outer sheath
	2)	Oxygen index test on outer sheath
	3)	Smoke density rating test on outer sheath
	4)	Acid gas generation test on outer sheath
	5)	Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable

G) Following tests shall be carried on one length of each size of each type of offered lot:		
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, marking of drum no. / Batch number of outer sheath extrusion
	2)	Measurement of Eccentricity & Ovality
GENERAL NOTE:		

(a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre: - Routine Test of manufacturer internal test reports are to be verified by owner and Main Contractor at the time of final inspection. Owner and Main Contractor will also witness routine tests on cables on 10% sample basis.

(b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre: - Routine Test of manufacturer internal test reports are to be verified by Owner at the time of final inspection. Owner will witness routine tests on cables for the first order on 10% sample basis and Main Contractor will witness routine tests on cables for the first order on 100% basis.

1. For Smoke Density rating test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.
2. For Acid Gas Generation test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.
3. For Oxygen Index test: if the test result without conditioning is within (+)7% of the minimum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.
4. In case the test results without conditioning do not meet the maximum/minimum specified value, the manufacturer may exercise the option of retesting the samples after conditioning as per standard.

SUB-SECTION– E-38
H.T. SWITCHGEAR

HT SWITCHGEAR

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

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought Out Items will be subject to NTPC approval.
3. Temperature rise test reports for diode plates with actual heat sink will be verified.

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

SUB-SECTION– E-39
MEDIUM VOLTAGE BUS DUCTS

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

Note:

1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

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

SUB-SECTION– E-40
L.T. POWER CABLE & CONTROL CABLE

LT POWER CABLES & CONTROL CABLES

ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test (as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti-termite coating on wooden drums	Constructional requirements feature as per specification	Routine & Acceptance Tests as per relevant standard & specification	FRLS Tests
Aluminum (IEC 60228)	Y	Y	Y	Y		Y										
Copper (IEC 60228)	Y	Y	Y	Y		Y										
XLPE Compound (IEC 60502-2 (2005))	Y		Y			Y	Y				Y					
PVC insulation Compound (IEC 60502)	Y		Y			Y					Y	Y				
FRLS PVC Compound (IEC-60754 Part-1)	Y		Y								Y	Y				Y
Extrusion & curing /Manufacturing of Core (PVC / XLPE)		Y			Y		Y					Y				
Core Laying								Y								
Armour wire/strip	Y	Y	Y													
Inner sheath	Y	Y														
Armoring		Y							Y							
Outer Sheathing		Y								Y						
Finished Cable (IEC-60754 Part-1, IEC 60332-part III cat B/relevant standard)								Y	Y	Y	Y	Y		Y	Y	Y
Wooden drum (relevant standard) /Steel Drum		Y											Y	Y		

Notes:

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

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all types (PVC / XLPE insulated) & sizes.**	
1)	Conductor Resistance test	
2)	High voltage test	
ACCEPTANCE TESTS	**Following Acceptance tests shall be carried out on each size of each type (PVC / XLPE insulated) of cables, in the offered lot.**	
A) For Conductor (as per sampling plan mentioned in IEC Pub 502 (1983)/ BS 6346:1969/ IEC 60502-2 (2005))		
	1)	Annealing test (Copper)
	2)	Tensile Test (Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IEC Pub 502 (1983)/ BS 6346:1969/ IEC 60502-2 (2005))		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects
C) For PVC / XLPE insulation & PVC Sheath (as per sampling plan mentioned in IEC Pub 502 (1983)/ BS 6346:1969/ IEC 60502-2 (2005))		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")
	3)	Hot set test (For XLPE insulation)
D) Ageing test:		
If the compound manufacturer is carrying out Ageing test, test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer will carry out ageing test & the test report will be reviewed by owner (quantum of ageing test sample shall be one sample /batch)		

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

(a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre: - Routine Test of manufacturer internal test reports are to be verified by owner and Main Contractor at the time of final inspection. Owner and Main Contractor will also witness routine tests on cables on 10% sample basis.
(b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre: - Routine Test of manufacturer internal test reports are to be verified by Owner at the time of final inspection. Owner will witness routine tests on cables for the first order on 10% sample basis and Main Contractor will witness routine tests on cables for the first order on 100% basis.

1. For Smoke Density rating test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.
2. For Acid Gas Generation test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.
3. For Oxygen Index test: if the test result without conditioning is within (+)7% of the minimum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.
4. In case the test results without conditioning do not meet the maximum/minimum specified value, the manufacturer may exercise the option of retesting the samples after conditioning as per standard.

SUB-SECTION– E-41
L.T. SWITCHGEAR

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

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

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

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

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

LT BUSDUCT

ATTRIBUTES, CHARACTERISTICS → / ITEM, COMPONENTS, SUB SYSTEM ASSEMBLY ↓	Dimension & Surface Finish	Make, Type, Rating & TC	Electrical Properties	Mechanical Properties	Chemical Properties	Item to conform to relevant IS	WPS Approval, Welder Qualification	Weld Quality Check (DP test & x-ray Test)	Paint Shade, Thickness, Adhesion & Finish	Tightness by Torque measurement	Electrical Clearances	Galvanizing Test as per IS 2629/ 2633/ 4759	IR – HV – IR Test	Phase Sequence Check	Degree of Protection routine test as per NTPC spec.
Aluminum Sheets / Plates / Strips / Flexibles / tubes (IS: 5082 / 737)	Y	Y		Y	Y	Y	Y	Y							
CRCA Flats / ISMC (IS 2062)	Y	Y		Y	Y	Y									
Neoprene / Synthetic Rubber Gaskets (IS 11149 / 3400)	Y	Y		Y	Y										
Rubber Bellows (IS: 3400)	Y	Y		Y	Y										
Support Insulator (BS: 2782, IEC: 660, IS: 10912)	Y	Y	Y	Y											
Galvanized Structure & GI Earthing Flat (IS: 2629 / 2633 / 4749)	Y	Y				Y						Y			
Space Heater & Thermostat		Y	Y										Y		
LT Busduct (IS: 8623 PART 2)	Y	Y				Y	Y	Y	Y	Y	Y		Y	Y	Y

Notes:

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

SUB-SECTION– E-42
MOTORS

MOTOR

ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY / TESTS/ CHECKS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing (WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-4722 /IS- 9283/ IS2148/ IEC60034/ IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y										
Shaft	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y			Y		Y			Y							
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	Y		Y	Y			Y					Y							
Tubes, for Cooler	Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y											
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y										
Wound stator	Y	Y					Y	Y											
Wound Exciter	Y	Y					Y	Y											
Rotor complete	Y	Y					Y						Y	Y					

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

Note:

1) The manufacturer is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, following methodology to be followed for Inspection Categorization:

Note for LT Motor:

i. Motor rating up to 50 KW: Inspection CAT- III: Acceptance of Motor up to 50 KW is based on COC of the Manufacturer and Main Contractor confirming as follows:

"It is hereby confirmed that the above-mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot starts, pull out torque, starting KVA/KW, temperature rise, distance between center of stud gland plate and tested in accordance with approved drawing /data sheets."

ii. ii) Motor rating above 50 KW & less than 75 KW: Inspection CAT- II as per NTPC approved MQP: Acceptance of Motor rating above 50 KW & less than 75 KW is based on NTPC review of Routine Test inspection report as per IS:12615 - 2018 (including latest revision) duly witnessed by main contractor along with COC of the Manufacturer and Main Contractor confirming as follows:

"It is hereby confirmed that the above-mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot starts, pull out torque, starting KVA/KW, temperature rise, distance between center of stud gland plate, space heater and tested in accordance with approved drawing /data sheets."

iii. iii) Motor rating 75 KW & above: Inspection CAT-I: As per NTPC approved MQP.

2) Additional routine tests for Flame proof motors shall be applicable as per relevant standard.
3) Makes of major bought out items for HT motors will be subject to NTPC approval.
4) Y1 = for HT Motor / Machines only.
5) For LT Motors, stator core stack length & grade, no load loss and winding resistance w.r.t. type tested motor for IE2/IE3 shall be checked/verified in addition to Compliance of relevant standard IS:12615/IEC requirement. In case actual results are not within the tolerance limit as declared by manufacturer during QP submission, the motor shall be subjected to efficiency test.

SUB-SECTION– E-43
SERVICE ELEVATOR (GEAR TYPE)

Passenger/ Service Elevators (GEAR TYPE)

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

Y1 –TEST TO BE DONE AT SITE
Y2 - LOAD/OVERLOAD TEST TO BE DONE AT SITE AS APPLICABLE.
Y3 – Burn in test on electronic card
Y4 – Routine tests including FRLS tests as per Tech. Spec.
Y5- Test report as per relevant std.
NOTE:
1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the applicable practices and procedures followed along with relevant supporting documents during QAP finalization.
2) Makes of all bought out items shall be subject to NTPC approval

SUB-SECTION– E-44
STATION LIGHTING

STATION LIGHTING

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

LED Luminaire quality requirements:

1) **LED modules to conform to IS: 16103 part 2. Manufacturer to issue a certificate of compliance for the same.**
2) **Control gear to conform to IS 15885-part 2 section 13. Manufacturer to issue a certificate of compliance for the same.**
3) **LED luminaire to conform to IS 16107-part 2 section 1. Manufacturer to issue a certificate of compliance for the same.**
4) **LED luminaire marking to be as per IS 16107-part 2 section 1. Manufacturer to issue a certificate of compliance for the same.**
5) **Acceptance tests as per IS 16107-part 2 section 1 to be carried out on LED luminaire except long duration tests i.e., a) Chromaticity coordinates & correlated color temperature (CCT); b) Color rendering index (CRI). Manufacturer will submit a COC for above tests i.e., CCT & CRI**
6) **LED drivers make, model, type & rating may be as per recommendations of LED module manufacturer**.

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

SUB-SECTION– E-45
SWITCHYARD

SWITCHYARD

ATTRIBUTES/ CHARACTERISTICS / ITEMS/COMPO-NENTS, SUB SYSTEM ASSEMBLY	Make, model, Type & Rating, Test Certificate	Routine & Acceptance Test as per IS / IEC	Functional requirements as per NTPC Specification
765 kV GIS (IEC:62271-203)	Y	Y	Y
400 kV GIS (IEC:62271-203)	Y	Y	Y
220 kV GIS (IEC:62271-203)	Y	Y	Y
132 kV GIS (IEC:62271-203)	Y	Y	Y
Circuit Breaker (IEC:62271-100)	Y	Y	Y
Isolator (IEC:62271-102)	Y	Y	Y
Current Transformer (IEC:60044/BS:3938/IS2705/ IEC: 61869)	Y	Y	Y
Capacitor Voltage Transformer (IEC:186A / 358/IS3156/IEC60044/ IEC: 61869)	Y	Y	Y
Potential transformer (IEC 60044 / IS3156)			
Surge Arrestor (AIS) (IEC:99-4/IS:3070)	Y	Y	Y
Wave Trap (IEC:353 / IS:8792 / 8793)	Y	Y	Y
Sub Station Automation system (IEC 61850)	Y	Y	Y
Protection Relays	Y	Y	Y
Energy meter	Y	Y	Y
Bus Post Insulator (IEC:168 / 815 / IS:2544)	Y	Y	Y
Disc, Pin & String Insulator (IEC:383 / IS:731)	Y	Y	Y
Aluminum Tube (IS:5082 / 2673 / 2678)	Y	Y	Y
Conductor (IS:398)	Y	Y	Y
Hardware fittings for Insulator(IS:2486 / BS:3288)	Y	Y	Y
Hollow insulator (IEC:233/ IS:5621)	Y	Y	Y
Spacers, Clamps & Connector (IS:10162 / 5561/ 617)	Y	Y	Y
Galvanized Steel Structures (IS:2062/2629/4759/6745)	Y	Y	Y
Vibration Damper (IS:9708)	Y	Y	Y

ATTRIBUTES/ CHARACTERISTICS / ITEMS/COMPO-NENTS, SUB SYSTEM ASSEMBLY	Make, Type Rating, and Model, Test Certificates	Routine & Acceptance Test as per relevant IS/IEC	Functional requirements as per NTPC Specification
Sag Compensating Spring DIN:2089/2096 IS:3195 / 7906	Y	Y	Y
Long rod Insulator	Y	Y	Y
SF6 Gas filling & evacuating plant	Y	Y	Y
SF6 Gas Leak Detector	Y	Y	Y
Leakage Current Analyzer	Y	Y	Y
Nitrogen Gas Filling Device	Y	Y	Y
Event Logger	Y	Y	Y
Operation Analyzer	Y	Y	Y
Disturbance Recorder	Y	Y	Y
Synchronizing Trolly	Y	Y	Y
Relay Test Kit	Y	Y	Y

Notes:

1) This is an indicative list of test/checks. The manufacture is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents during QP finalization for all items.

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

SUB-SECTION– E-46
DIESEL GENERATOR SET

DIESEL GENERATOR SET

DIESEL ENGINE

ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY / TESTS/ CHECKS	Material Test	DP/MPI	UT (On forging and piston Bonding)	Balancing	Hydraulic/water fill test	Assy./fit up	Dimension	Functional/Operation test	Performance test as per BS-5514/or equivalent IS/ISO-Standard including Governing Test for 3 hours at full load	Fuel consumption, rated power measurement, rated speed	All other tests (if applicable) as per Spec./ relevant
Crank shaft	Y	Y	Y	Y							
Cylinder blocks/heads	Y				Y						
Liner/ Radiator	Y				Y						
Rotating/moving parts other than crank shaft	Y	Y									
Piston	Y	Y	Y								
Diesel Engine						Y	Y	Y	Y	Y	Y

Note:

1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

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

ALTERNATOR

ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY / TESTS/ CHECKS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing (WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All Routine tests as per IS-/IS-472	Vibration	Over speed	Tan delta, shaft voltage & polarization index test
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y					Y									
Shaft	Y	Y	Y	Y	Y	Y			Y									
Magnetic Material	Y	Y	Y	Y	Y		Y			Y		Y						
Rotor Copper/Aluminum	Y	Y	Y	Y		Y	Y		Y									
Stator copper	Y	Y	Y	Y			Y		Y			Y						
SC Ring	Y	Y	Y	Y	Y	Y	Y	Y	Y									
Insulating Material	Y		Y	Y			Y					Y						
Tubes for Cooler	Y	Y	Y	Y	Y				Y		Y							
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y							
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y										
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y										
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y				Y									

ALTERNATOR

ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY / TESTS/ CHECKS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing (WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All Routine tests as per IS-/IS-4722	vibration	Over speed	
	Y	Y					Y	Y										
Wound Exciter	Y	Y					Y	Y										
Rotor complete	Y	Y					Y						Y	Y				
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y											
Accessories, RTD, BTD, CT,AVR. Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y															
Alternator (IS 4722)	Y	Y	Y												Y	Y	Y	Y1

Note:

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

Y1= for HT Machines only.

FINAL ASSEMBLY										
TESTS/ CHECKS / ITEMS/COMPONENTS	Material Test	Dimension	WPS/PQR/Welding	NDT/DP/MPI/UT	Check completeness	Hydraulic/Leak/Pressure test	Functional Tests	All routine test as per Spec/ IS	No load test for 5 min & partial loads for one hour of the DG set assembly	Clearances & Alignment
Base frame	Y	Y	Y	Y	Y					
Fuel Tank	Y	Y	Y	Y	Y	Y				
Battery								Y		
Battery Charger								Y		
Control Panel								Y		
Assembled DG Set		Y			Y		Y		Y	Y

NOTES:

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

SUB-SECTION– E-47
VFD MODULES

VFD MODULE

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

Note:

1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization.
2) Make of all major Bought Out Items will be subject to NTPC approval.

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

Note:

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

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

DRY TYPE TRANSFORMER

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

Notes:

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

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

VFD PANEL

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

NOTE:

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

TRANSFORMER (OIL FILLED)

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

Note:

1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

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

SUB-SECTION– E-48
CONSTRUCTION POWER RING MAIN & LT SUB-STATION, HT LINES

CONSTRUCTION POWER – RING MAIN & LT S/S & HT Lines

Attributes / Characteristics / Items / Components / Sub System Assembly	Dimensions & finish	Make, Model, Type, Rating & TC	Item to conform to relevant standards	Functional & Operational features as per NTPC spec.	Galvanizing Tests	Pretreatment as per IS 6005	Paint shade, thickness, adhesion & finish	Functional Checks	All Routine / Acceptance Tests as per NTPC Spec. & IS
HT AC Switch Outdoor type (IS: 9920)	Y	Y	Y	Y		Y	Y	Y	Y
Outdoor HT Fuse & Fuse base (IS : 9385) /Drop Out Fuse Assembly	Y	Y	Y	Y				Y	Y
HT Outdoor Type Lightning Arrester (IEC : 99 - 4)	Y	Y	Y						Y
ONAN Transformer (IS 2026)	Y	Y	Y						Y
LT Power Control Centers (IS 8623)	Y	Y	Y						Y
Distribution Boards / Fuse Boards (IS 8623)	Y	Y	Y						Y
HT armored Cable (IS : 7098)	Y	Y	Y						Y
LT armored Power & Control cable (IS : 1554)	Y	Y	Y						Y
Cable Termination Kits and Straight Through Joints (VDE 0278)	Y	Y	Y						Y
ACSR Conductor (IS : 3835)	Y	Y	Y						Y
Earth wire & Guy wire/ Stay set (IS : 6594)	Y	Y	Y						Y
Galvanized Steel Structure (IS 2633 / 2629 / 6745 / 802)	Y	Y	Y		Y				Y
Steel Tubular Poles (IS 2713)	Y	Y	Y			Y	Y		Y
Rail Poles (IRS : 90 L)	Y	Y	Y			Y	Y		Y
ISMC Channel / Angle / Flat (IS 2062)	Y	Y	Y						
Hardware (IS 1367)	Y	Y	Y						
Disc & Pin Insulator (IS 731)	Y	Y	Y						Y
Strain Porcelain Insulator (IS 5300)	Y	Y	Y						Y
Suspension / Tension Clamp for Earth wire (IS 398 Pt 2)	Y	Y	Y						Y
Hardware for insulator (IS 2586)	Y	Y	Y						Y
Vibration damper (IS 9708)	Y	Y	Y						Y
LT Air Circuit Breaker (IS : 13947)	Y	Y	Y	Y				Y	Y
LT CT / PT (IS : 2705 / 3156)	Y	Y	Y						Y
MCB (IS : 8828)		Y	Y	Y				Y	Y
MCCB (IS : 13947)		Y	Y	Y				Y	Y
Air Break Switch / LT Fuse (IS : 13947 / 13703)		Y	Y	Y					Y
Control & Selector Switches (IS : 6875)		Y	Y	Y				Y	Y
CT / PT (IS : 2705 / 3156)		Y	Y	Y				Y	Y
Energy Meters (IS 722)		Y	Y	Y				Y	Y
Indicating meters (IS : 1248)		Y	Y	Y				Y	Y
Push Buttons (IS : 4794)		Y	Y	Y				Y	Y

Attributes / Characteristics Items / Components / Sub System Assembly	Dimensions & finish	Make, Model, Type, Rating & TC	Item to conform to relevant standards	Functional & Operational features as per NTPC spec.	Galvanizing Tests	Pretreatment as per IS 6005	Paint shade, thickness, adhesion & finish	Functional Checks	All Routine / Acceptance Tests as per NTPC Spec. & IS
Indicating Lamps (IS: 13947)		Y	Y	Y				Y	Y
PVC insulated copper wires (IS : 694)		Y	Y	Y					Y
Cable Lugs / Cable Glands (IS 8309 / BS 6121)		Y	Y	Y					Y
Lighting Fixtures (IS 10322)	Y	Y	Y						Y
GI Pipe for Earthing (IS : 2629 / 2633 / 4749)	Y	Y	Y		Y				
Fence (IS : 278)		Y	Y						
Danger Plate (IS 2551)			Y						Y

Notes:

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

SUB-SECTION– E-49
QA TABLE FOR SOLAR ROOF

SPV MODULE

This is indicative List of tests/ checks. The manufacturer is to furnish a detailed quality Plan indicating the practice & procedure along-with the relevant supporting documents.

1. PCU-

A) Incoming Quality Checks on bought out items
B) In-process quality checks
C) Routine tests as per following on the assembled PCU:
   1) Test to demonstrate automatic / manual synchronization and connection to utility service
   2) Functional check on all protections
   3) Check on accuracy of all parameters measured by PCU
   4) Test to demonstrate operation of start-up, stable operation of the PCU, disconnection and shutdown controls and response to other control signals
D) Following sample tests assembled PCU: (1 Unit per offered lot)

Heat run test including measurement of phase currents, efficiencies, harmonic content and power factor at four points preferably 25, 50, 75 and 100% of the rated nominal power.

2. SPV module-

SPV modules quality plan should include the following:
A) Incoming Quality Checks on bought out items (listed in third party test reports of relevant standard)
B) In-process Quality Checks
C) Sample tests as per following:
   1) SPV modules to be checked visually for following defects: (sampling as per General Inspection Level II and AQL 1.5% as per IS 2500 Part 1)
      a) Scratches on the frame and/or glass
      b) Excessive or uneven glue marks on glass or frame
      c) Inconsistent cell colours
      d) Completeness of module in all respects
   2) Performance of SPV module at STC (sampling as per General Inspection Level II and AQL 1.5% as per IS 2500 Part 1)
   3) IR-HV-IR test (sampling as per General Inspection Level II and AQL 1.5% as per IS 2500 Part 1)
   4) Robustness of terminations on 1 sample per offered lot
   5) Mechanical load test on 1 sample per offered lot

3. Array Junction Box / String Monitoring Box-

Array Junction quality plan should include the following:
A) Checks on bought out items as per internal standards of the manufacturer
B) In-process checks, as per internal standards of the manufacturer
C) Sample tests as per following:
   1) IR-HV-IR test (sampling as per General Inspection Level-II and AQL 1.5% as per IS 2500 Part 1)
   2) String Monitoring Card/ Power Supply card/ DC-DC Converter function check on one sample of SMB (In case of String Monitoring Box only)
   3) Communication Function Test on one sample (In case of String Monitoring Box only)
   4) Degree of protection visual checks like gasket profile, sealing arrangement, paper pull check

4. DC Cable-

Routine and Acceptance Test as per the relevant Standard applicable as per technical specifications.

SUB-SECTION– E-50
VMS & TSI SYSTEM

VMS & TSI System

TEST/ATRIBUTES CHARACTERISTICS / ITEM	Linearity(R)	Frequency Response(R)	Calibration with simulated output.(R)	Spectrum(Harmonic Analysis (A)	Predictive Analysis Functions (A)	Storage & Comparative analysis of vibration(A)	Generation/analysis of plots (A)	Simulation test & generation of operator guidance (A)
TURBO SUPERVISORY/ VIBRATION MONITORING SYSTEM								
Proximeter	Y	Y						
Acclerometer	Y	Y						
LVDT	Y							
Monitor	Y		Y*					
Overall System				Y	Y	Y	Y	Y

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

Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supplying documents.

* applicable for monitor electronics

SUB-SECTION– E-51
MEASURING INSTRUMENTS

MEASURING INSTRUMENTS **Page- 1/2**

Item Components Sub System Assembly	Attributes Characteristics								
	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (As applicable)(R)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-60770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
7. Transducer (IS-14570)	Y	Y	Y	Y	Y	Y			
8. Thermocouples (IEC – 584 / ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
9. RTD(IS-2848)	Y	Y	Y	Y	Y	Y			
10. Thermowell	Y		Y				Y	Y	Y

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

Note: **1)** This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.

MEASURING INSTRUMENTS **Page- 2/2**

Item Components Sub System Assembly	Attributes Characteristics													
	GA, Dimensions, Paint Thickness (B)	Make, Model, Type, Rating	Process / Electrical connection (R)	Calibration/Functional (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	HV/ IR Test (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)	Integral Testing of complete
11. Orifice plate(BS-1042)	Y	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y	
12. Flow nozzle(BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Y	Y	Y	
13. Impact head type element	Y	Y	Y					Y				Y	
14. Electronics Water Level Indicator (EWLI)	Y	Y	Y		Y		Y		Y	Y	Y	Y	Y
15. Flue Gas & Ambient Air Analysers	Y	Y	Y	Y					Y				Y
16- SWAS System with Analyser & Chiller#	Y	Y	Y	Y			Y		Y	Y	Y	Y	Y
17- Dust emission monitors	Y	Y	Y	Y									
18- Containerised Room	Y	Y	Y						Y			Y	

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

*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.
** As applicable
#Vaccuminasation test of chiller assembly

Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.

SUB-SECTION– E-52
DDCMIS

CLAUSE NO.	QUALITY ASSURANCE

1.00.00 REQUIREMENTS OF AUTHORISATION-TO-SHIP-TEST (ATST) FOR DDCMIS

(a) Authorization-to-ship-test (ATST) or Factory Acceptance Test (FAT) (both terms have been used interchangeably) shall include all required tests to fully demonstrate to Employer's satis¬faction that each equipment/sub-system/system as well as software modules furnished as per this specifica-tion as well as DDCMIS as a whole, fully meets the functional, parametric and other requirements of this specification and Employer's approved drawings/documents under all operating regimes. The procedure defined here is applicable for one DDCMIS system. Number of DDCMIS systems and their sub-systems shall be as defined in Part-A of technical specifications.

(b) Contractor to note that ATST / FAT procedure given below in subsequent clauses are only indicative in order to help the Contractor in understanding the require¬ments and help him in submitting a detailed pro¬cedure based on these guidelines meeting all the specification requirements.

(c) The results of the following activities shall be made available to the Employer's representative before start of ATST / FAT.

(i) Compliance check for Major Design Feature (including Customization if any), as per Part-C, GTR or agreements regarding this.

(ii) Implementation check of various applications including those based on NTPC input, as per Part-C, GTR or agreements regarding this.

(d) Generally, the ATST / FAT shall be carried out with the equipment earmarked for the particular project and unit. However, for the following item, the testing can be carried out with similar / equivalent dummy equipment fulfilling the following condition, subject to Employer's approval.

SN	ITEM	CONDITION
1	LVS	Testing of LVS functionalities can be done by using monitors connected to the LVS Workstations. Dispatch of LVS can be allowed like a cat-III item, but only after successful testing of functionalities as indicated above.
2	LVS WS / OWS	LVS WS / OWS for the first unit to be tested on the target machines. In case the testing carries over to next unit, dummy equipment may be used. Dispatch of LVS WS / OWS of subsequent units can be allowed like a cat-III item, but only after successful testing of first unit as indicated above.
3	MASTER CLOCK	Can be directly dispatched if alternate test set-up for time synchronization can be arranged.
4	NETWORK COMPONENT	To be done with target machines only for first unit. In case the testing carries over to next unit, dummy equipment may be used. Dispatch of network components of subsequent units / station can be allowed like a cat-III item, but only after successful

		testing of functionalities as indicated above.
5	VARIOUS BUS SYSTEM CABLES	For FAT, the target Main system bus shall be used. In case the testing carries over to next unit, dummy equipment may be used.

1.01.01 The Authorization-To-Ship-Test (ATST) shall include all reasonable exercises which the combination of equipment and software can be expected to perform. These tests shall be divided into, as a minimum, but not limited to the following categories:

(a)	Hardware tests	
(b)	Functional tests	
(c)	Parametric test	

All reference documents like all approved drawings / documents, NTPC specifications, DDCMIS system manuals, etc. shall be available at the start of ATST. The Quality Assurance related tests shall be as per approved QP (Quality Plan) for DDCMIS. The ATST tests are briefly described in subsequent clauses.

1.01.02 **Hardware tests**

These tests shall include but not be limited to the following tests. These tests will be conducted on full population on sample basis as finalized during ATST procedure finalization and NTPC engineer's decision during ATST.

(a.) Verification of healthiness of all types of modules e.g., I/O modules, controller modules, processors, peripherals, etc. on a sample basis.

(b.) System configuration:

(1.) Verification of system configuration with reference to approved configuration diagrams including verification of controller configuration, group / sub-group segregation; grouping of controllers, I/O redundancy, verification of multiple measurement scheme, HMIPIS configuration, etc.

(2.) Verification of major features of complete DDCMIS like on line removal of I/O and controller modules, etc. in line with specification requirements.

(3.) Verification of spare capacity for example spare channels, spare wired-in space in cabinets/ cubicles, terminal blocks, peripherals, etc. as per approved documents.

(c.) Simulation of inputs / Outputs

System shall have feature to simulate/ forcing I/Os on OWS / LVS OWS. Additionally, hardware simulation of I/Os shall be available for specific applications like fail safe system.

(d.) Accuracy test:

System accuracy for each type of analog input shall be demonstrated on sample basis, if this test is not carried out in MDFT.

(e.) Demonstration of the manual and auto switchover from master to standby system bus, controllers, I/Os, processors etc.

(f.) Loop reaction time shall be demonstrated for loops / logics / functions applicable as per specification and ATST procedure.

(g) SOE function shall be tested as follows, where the same is applicable (refer Part-A of specifications). For SER function, verification of resolution of SOE inputs, time synchronization with master clock, data base modification, SOE report, printout, other features etc. For this purpose a test-simulator to generate sequences of 1 ms resolution for 50 points (or as agreed during finalization of ATST procedure) distributed in different panels shall be made available during testing.

(h) Power supply:

Testing of power supply system to DDCMIS, tolerance of DDCMIS w.r.t. voltage & frequency limits as specified, performance of DDCMIS with power supply break as specified .(One sample of each type)

(i) Diagnostics Tests :

On – line diagnostic tests on HMIPIS, individual peripherals, Control System, programmer stations, etc.

1.01.03 Functional Tests

The following tests shall be carried out on Contractor's DDCMIS.

(a.) Functional tests of CLCS:

(1.) Verification of proper signal acquisition, conditioning and distribution, 2 transmitters / 3 transmitter selection.

(2.) Verification of proper realization of controller functions like bump less transfer from auto to manual and vice versa, functional checking of bias circuit (wherever provided), etc.

(3.) Verification of response of control system by simulating changes in the system inputs in line with the approved ATST procedure.

(4.) Verification of signal exchange between FGs and from other systems (if applicable)

(b.) Functional tests of OLCS:

(1.) Verification of proper signal acquisition, conditioning and distribution, 1v2, 2v3 implementation.

(2.) Verification of proper realization of logic functions, sequence control functions, running of complete start up program sequence in all modes of operation, shut down program, etc.

(3.) Verification of logic computation in controller by simulating inputs.

(4.) Verification of signal exchange between FGs and from other systems (if applicable)

Commented [AD1]: Updated as per discussion with Control System Group.

(c.) Functional tests for HMIPIS

(1.) Verification of all types of displays, logs including their formats, bar graphs, X-Y plots etc. availability of all operator functions.

(2.) Verification of event generation and handling capabilities of HMIPIS processors by simulating various types of events/data and observing associated event sequence display and alarms..

(3.) Calculations:

All calculations shall be tested on sample basis to demonstrate that these are in accordance with the specification and Employer's inputs as applicable. The Contractor shall prepare ~~all~~ tests cases for calculations for proper verification for the features required for each type of computations.

(4.) Checking historical storage and retrieval functions including long term storage.

(5.) Testing of initialization and loading of configuration data, etc.

(6.) Verification of all programmer's stations functions for HMIPIS and Control System, as well as for documentation facility as specified.

(7.) Testing of each peripheral viz., monitors, printers, optical disks, hard disk drive, etc.

(8.) Testing of time synchronization function of system time of DDCMIS (Control System, HMIPIS & Systems on LAN). In case it is not possible to bring the master clock procured under this package, then signal generator with stable source, capable of generating all required type of synchronizing signal to be arranged by Contractor.

(9.) Testing of the Station LAN shall be carried out with unit DDCMIS (with panels), standalone DDCMIS (with panels or software simulation), Switchgear DDCMIS and at least one (1) other DDCMIS system (with panels or software simulation), as well as two client PC's, one third party PLC and Numerical relay system (if applicable). Bidder shall arrange a PC with OPC server (excluded from his scope of supply) which shall be used by the Bidder to simulate signal exchange between Bidder's Station LAN and third party PLC during the testing of Station LAN, at Bidder's works .

During the testing of Station LAN as mentioned above complete switchgear DDCMIS (with panels) shall be connected. Numerical Relay & Ethernet Switch Vendor will arrange a prototype ring with at least three Ethernet switches (L2) with one IED of each type and L3 Switches network, at the works of the DDCMIS supplier along with the necessary engineering support. Exact test setup shall be finalized during detailed engineering.

(10.) Unified HMIPIS:

Testing of Unified HMIPIS functionality as per respective approved documents.

(d.) Security Audit (as applicable)

(1.) For checking compliance to the security policies & procedures in Station LAN/HMI of all DDCMIS **and Switchgear Relay network integrated to the Switchgear DDCMIS,** security audit by a certified auditor (as per CERT- IN panel) is to be arranged by the Contractor during ATST. **The security audit for Switchgear Relay network integrated to the Switchgear DDCMIS shall be done on prototype ring and hardware arranged by the vendor during Station LAN FAT.** This shall include vulnerability assessment of the workstations/ servers and penetration testing of the Station LAN through the firewall from a node outside the network. Suitable actions based on the findings of the security audit shall be carried out by the Contractor.

1.01.04 **Parametric tests**

Following tests shall be carried out to test Contractor's DDCMIS w.r.t. specification requirements.

(a.) For control system (CLCS+OLCS):

(1.) CPU loading

(2.) Cycle time/controller reaction time.

(3.) Memory spare capacity

(b.) For MMIPIS

(1.) CPU loading

(2.) Spare duty cycle

(3.) Spare memory capacity

(c.) Spare duty cycle for system bus

(d.) Various display & command response time

(e.) System accuracy (if not carried out in MDFT)

(f.) Display update time on OWS LVS

Parametric tests of Unified HMIPIS for complete Unit DDCMIS shall also be carried out, if specified in Part-A of specifications

1.02.00 **Integrated Test Set-Up**

For integrated testing of the total DDCMIS system, the Contractor shall employ a test set-up, which will be capable of generating I/O signals in a requisite manner. It is preferable to adopt soft signal simulating device to avoid / minimise the cumbersome process of physical connection of I/Os through potentiometers, switches, Lamps / LEDs etc. The exact configuration / set-up shall be as finalized during detailed engineering.

1.02.01 The Contractor is to submit Authorisation-To-Ship-Test (ATST) procedure and requirements of above and other applicable clauses of this specification. Since, the exact definition & extent / parameters of ATST can be finalized only when the engineering of DDCMIS has been finalized to a great extent, it is required that the detailed draft ATST procedure be submitted by the Contractor at a later date as intimated by the Employer during engineering stage for Employer's comment and

	finalization. Contractor shall incorporate all modifications, additions/ deletions to the ATST procedure as indicated by the Employer. The ATST shall be conducted as per Employer approved procedure for ATST. The Employer reserves the right to ask the Contractor to conduct any other test not covered in ATST procedure also during the ATST which may be required to fully satisfy the Employer regarding full compliance with specification requirements. Contractor shall conduct all such tests also within the quoted lump sum price for this contract.
1.02.02	The results of all ATS Tests shall be properly docu¬mented by the Contractor and submitted to Employer along with all annexures.
1.02.03	Following the tests, if in the opinion of the Employer, the system has not been adequately manufactured, programmed, tested or debugged the Contractor shall make good all deficiencies, and re-run the test to fully satisfy the Employer regarding full compliance with specification requirements and requisite quality standards.
1.02.04	The system shall not be shipped without approval of Employer in writing.
1.02.05	Upon successful completion of Authorization-To-Ship Test, the Employer will provide the Contractor with a written authorization for shipment of the system equipment to the project site.
1.02.06	All final documentation as per requirement of this specification shall be available at the time of Authorization-To-Ship-Test and this shall be dispatched along with the equipment in required number of copies.
1.02.07	Contractor shall note that no payments towards dispatch of equipment and subsequent activities shall be due and payable to the Contractor till the Contractor is able to successfully demonstrate to Employer's satisfaction that the DDCMIS and parts thereof fully meet the Authorization-To-Ship Test requirements.
1.02.08	The ATST or FAT of DDCMIS shall be conducted at the employer approved works of the DDCMIS supplier or DDCMIS Supplier's Associate. Further DDCMIS shall be supplied from the same works.
2.00.00	The ATST requirements as indicated above shall form an integral part of QAP (Quality Assurance Plan) of DDCMIS system(s) envisaged for the package/project. Over and above the tests and requirement indicated above, the QP for DDCMIS system shall be submitted to employer for approval. The QAP envisaged for the offered DDCMIS system for employer shall also include testing of following attributes of the offered system by Employer.
2.01.00	The tests indicated in the following QA tables are indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents, if desired by employer.

DISTRIBUTED DIGITAL CONTROL MONITORING & INFORMATION SYSTEM (DDCMIS)

TESTS / ITEMS	Pre Power on Check (#) (R)	Post Power on Check (%) (R)	Internal cabling / Wiring checking(R)	Door Alignment, waviness, and Locking (R)	Louvers, Fans, wire mesh, Lifting arrangement (R)	HV / IR on wired panels (R)	Paint Shade, Thickness and Illumination (R)	Hardware/Make as per BOM (R)	Dimensions, GA, layout (R)	Environmental Stress Screening test (R).
DDCMIS										
DDCMIS CUBICLES	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
OWS and Peripherals								Y		

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

Note: 1) These test are minimum requirement and necessary covered in Manufacturing Quality Plan and manufacturer is also need to include their practices and Procedure in MQP along with relevant supporting documents.

Pre power on check: - Wire dressing, looseness, Availability of Fuses and MCB, Modules are inserted properly, Earthing connection, Input Voltage checking, Availability of resistance matt near panels, Availability of Electro Static Discharge measure for electronics components.

% Post Power On Check: - Current & power consumption of DDCMIS Cabinets, I/O check as per signal flow.

SUB-SECTION– E-53
POWER SUPPLY

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

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

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

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

Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.

SUB-SECTION– E-54
INSTRUMENTATION CABLE

INSTRUMENTATION CABLE

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

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

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

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

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

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

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

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

SUB-SECTION– E-55
CONTROL VALVE

CONTROL VALVE ACTUATORS AND ACCESSORIES.

TESTS / ITEMS	MAKE,MODEL, TAG (R)	DIMENSION®	SURFACE FINISH®	HEAT TREATMENT®	MATERIAL TEST CERTIFICATES®	IBR CERTIFICATES®	HYDRAULIC TEST , SEAT LEAKAGE ®	UT/RADIOGRAPHY FOR >900 LB RATING®	MPI/DP®	PRESSURE RESISTANCE®	TIMING OPEN/CLOSE®	LINEARITY/HYSTERISIS®	FUNCTIONAL TEST, REVIEW FOR MAKE AND TC OF ACCESSORIES®
CONTROL VALVE AND ACTUATOR													
OVERALL	Y	Y	Y			Y	Y				Y	Y	Y
BODY		Y	Y	Y	Y			Y	Y	Y			
BONNET		Y	Y	Y	Y								
TRIM		Y			Y			Y*					
PNEUMATIC ACTUATOR	Y	Y								Y			
ELECTRO PNEUMATIC POSITIONER	Y												Y

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

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

NOTE : 1) THIS IS AN INDICATIVE LIST OF TESTS/CHECKS. THE MANUFACTURE IS TO FURNISH A DETAILED QUALITY PLAN INDICATING HIS PRACTICE & PROCEDURE ALONG WITH RELEVANT SUPPORTING DOCUMENTS DURING QP FINALISATION FOR ALL ITEM.

SUB-SECTION– E-56
ELECTRICAL ACTUATOR

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER													
Test/Attributes Characteristics ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator ®	EPT output ®	Local/ Remote (Open-Stop-Close) Operation®	Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR with Integral Starter , Non- Intrusive Electrical Actuator (EN15714-2)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.

- SIL 2 certificate if applicable

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

SUB-SECTION– E-57
PROCESS, CONNECTION & PIPING

Process, Connection & piping FOR C&I SYSTEMS

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

*-applicable for painted junction boxes.

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

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

SUB-SECTION– E-58
SURVEILLANCE & COMMUNICATION SYSTEM

Survellance & Communication System, PLC, Fire ,LVS & Control Desk								
Item Components Sub System Assembly	Attributes Characteristics							
	Make, Model, Type, Rating, BOM®	GA/ Dimension / Paint Shade & Thickness®	Functional / operational check®	Switching capability and sequence®	HV/ IR Test®	SPL level and Sweep test response®	PAN Range / Tilt Speed/Zoom	FAT / Integrated Function Test along with Other System
IP Based PA System								
Components- Call Stations, Amplifier, Loud Speaker, Master Control Unit, Acoustic Hood, Enclosure , Power Supply, LAN Switch, Server, Work Station, Storage, Software	Y	Y	Y	Y		Y		
IP PA -Complete System	Y	Y			Y			Y
IP Based CCTV								
Component- Camera, Keyboard, Joystick, Housing, Pan-Tilt Unit , LAN Switch, Server, Work Station, Storage, Software	Y	Y	Y	Y			Y	
IP CCTV-Complete System	Y	Y			Y		Y	Y
Large Video Screen	Y	Y	Y					Y
Modular Control Desk with draw-out console	Y	Y	Y		Y			Y
PLC (IEC-1131)	Y	Y	Y		Y			Y
Fire Detection System(EN-54 Pt-2/Pt-5/Pt-7, UL 268,UL 521, UL-864)	Y	Y	Y					Y

Note : 1) This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure along with relevant supporting documents.

R –Routine Test Y -Test Applicable

SUB-SECTION– E-59
CIVIL WORKS WITH ANNEXURE

QA CIVIL WORKS

1.0 SAMPLING AND TESTING OF CONSTRUCTION MATERIALS

a) Before execution of any civil work the contractor shall conduct full-scale suitability tests on various construction and building material such as soil, fine and coarse aggregates, cement, construction chemicals, supplementary cementitious materials and construction water to ascertain their suitability for use and the concrete mix designs conducted from reputed institutes such as NCCBM-Ballabgarh, CSMRS-Delhi, selected IIT's as agreed by the Employer. The test samples for such full-scale testing shall be jointly sampled and sealed by the Employer and contractor, thereafter these shall be sent to the concerned laboratory through the covering letter signed by field quality assurance department (FQA) representative of the Employer. Format for sampling and testing of cement, coarse aggregate, fine aggregate, chemical admixture, fly ash, water, concrete mix design is enclosed at **Annexure-I.**

b) The contractor shall timely initiate the action with regard to the evaluation of aggregates and other building material including concrete mix design, so as to ensure completion of these tests before start of civil works at site, thereby not affecting any project work. The test reports and recommendations for suitability of the materials including concrete mix design shall be promptly submitted by the contractor to the Engineer-in-charge (EIC)/Head of Field Quality Assurance (FQA) Department of Employer.

2.0 LABORATORY AND FIELD TESTING

a) The field laboratory for QA and QC activities shall be established and installed with the adequate facilities to meet the requirement of envisaged day to day tests during execution of the work. Temperature and humidity controls shall be available wherever necessary during testing of samples. The contractor shall furnish a comprehensive list of testing equipment/ instrument required to meet the planned/scheduled tests for the execution of works for EIC acceptance/ approval. The contractor shall establish the requisite laboratory equipment/set up and skilled QA&QC manpower within 30 days from the mobilization date of Main contractor at site.
The tests which cannot be carried out/do not have facilities for testing in the field laboratory shall be done at Employer acceptable third-party testing laboratory.

b) All equipment and instruments in the field shall be calibrated before the commencement of tests and then at regular intervals, as per the manufacturer's recommendation and as directed by the EIC. The calibration certificates shall specify the fitness of the equipment and instruments within the limit of tolerance for use. Contractor shall arrange for calibration of equipment and instruments by NABL or such accrediting agency complying with ISO/IEC-17025 accreditation and the calibration reports shall be submitted to EIC for their review and acceptance.

c) The QA and QC activities (include all works, activities, equipment, instrument, personnel, material etc. whatsoever associated to comply with sampling, testing and quality assurance requirements) in all respects as specified in the technical specifications/ drawings / data sheets / quality plans / relevant standard codes / contract documents shall be carried out at no extra cost to the Employer.

d) The contractor shall carry out testing in accordance with the relevant IS/standards /codes and in line with the requirements of the technical specifications / quality plans. 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 EIC.

3.0 FIELD QUALITY PLAN

a) Well before the start of the work, the contractor shall prepare and submit the Field Quality Plans (FQP) and obtain approval of Employer, which shall detail out for all the works, equipment, services, quality practices and procedures etc. in line with the requirement of the technical specifications to be followed by the contractor at site. This FQP shall cover for all the items / activities covered in the contract / schedule of items required, right from material procurement to completion of the work at site. An Indicative Field Quality Plan for civil works is enclosed at **Annexure II** for reference purpose.

4.0 PURCHASE AND SERVICE

a) To facilitate advance planning of material testing/ approval of bought out items (BOI), well before the start of activity as per L-2 network, representative samples shall be procured by the contractor from approved sub-vendors and submitted to the EIC for his approval before bulk procurement. In case of manufacturers test certificate (MTC) is submitted for acceptance, it shall be clearly traceable and correlated with the consignment received at site. MTC of all bought out items (BOI) shall essentially contain all the test parameters / characteristics specified in the technical specifications / standards / codes. In case the manufacturer's test certificate does not mention these details, sample from each lot shall be tested at the Employer acceptable third-party lab. Approval of material / sample by the Employer shall not relieve the contractor of his responsibility, for their conformance to the specification, as well as the requisite performance and quality of material.

b) Structural steel (plates and rolled sections i.e. channels, beams & angles) conforming to IS 2062 and Reinforcement steel conforming to IS 1786 supply if in the scope of the contractor shall be procured from Primary Steel Producers (Refer NOTE below). Currently, Primary Steel Producers acceptable 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), Arcelormittal Nippon Steel India Ltd. (for Flat products/ Steel Plates), ESL Steel Ltd. (for Reinforcement steel/TMT bars) and JSW Ispat Special Products Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars). Subsequently, if any new Primary Steel Producer/s are proposed during execution of contract, the same may be considered for acceptance subject to meeting the following qualifying requirements:

i) The proposed supplier should be a Primary Steel Producer, having a minimum production capacity of one million tons per annum (MTPA).

ii) The proposed supplier should be a regular manufacturer of Steel Plates and / or Rolled Sections and / or Reinforcement Steel for the last two years as on date of submission of proposal.

iii) The proposed supplier should also be a registered licensee with Bureau of Indian Standards for BIS: 1786/2062 at the time of submission of proposal.

NOTE: The "Primary Steel Producer" shall mean Steel Producer of any capacity, irrespective of process route, starting their operations from iron making using iron ore, virgin or processed, with necessary refining facilities and rolling/processing facilities, at a single location or else in multiple locations provided that the entire gamut of iron & steel production, from iron making to finished steel production, is owned by the same company or its subsidiary company(ies). Provided that the iron making capacity is sufficiently matching the steel making capacity. Further, downstream units should use material from the upstream units of the same company or its subsidiaries.

In case of non-availability of certain steel section/s i.e. Angle smaller than 100x100x10 mm, MS flats, rounds, square bars and chequered plate from above acceptable primary steel producers, an option is given to the Main contractor to

source these sections directly from SAIL Conversion/Wet Leasing agent subject to the conditions given at point no. A) below:

A) Approval conditions for procurement of structural steel sections through SAIL Conversion/Wet Leasing agent:

1. Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for Employer supply.
2. Billets shall be procured from Employer approved Main Steel Producers. Proper records for traceability from raw material to final product shall be maintained.
3. 100% chemical analysis of the raw material (Billets) shall be carried out as per IS: 2830. Testing of one sample per 40 MT for each type of section or part thereof shall be carried out as per IS: 2062 on finished product.
4. Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC). MTC of finished sections shall be correlated with original MTC for Billets received from Main Steel Producer and Manufacturer Test Report of chemical analysis of Billets mentioned at point no.3. MTC of finished sections shall include the reference of MTC for Billets from Main Steel Producer.
5. Employer will have access to carry out the surveillance checks for in-process stage.
6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to Employer.

In case of non-availability of certain size/s of steel tubes conforming to IS:1161 and Hollow (square and rectangular) steel sections conforming to IS: 4923 from above acceptable primary steel producers, the same may be sourced from BIS approved sources having valid BIS license subject to the conditions given at point no. B) below:

B) Approval conditions for procurement of Steel tubes conforming to IS: 1161 and Hollow (square and rectangular) steel sections conforming to IS: 4923 from BIS approved sources:

1. Main Contractor to ensure continuity of BIS license of the manufacturer for the sections being manufactured for Employer supply.
2. Raw materials shall be procured from Employer approved Main Steel Producers.
3. 100% chemical analysis of the raw material (steel) shall be carried out as per IS: 228. Testing of samples of steel tubes and hollow sections from each lot shall be carried out as per IS: 1161 & IS: 4923 respectively on finished product.
4. Each lot of delivery of finished product shall be accompanied with co-relatable Manufacturer's Test Certificate (MTC).
5. Employer will have access to carry out the surveillance checks for in-process stage.
6. In case of any defects are seen in the material, Main Contractor will replace the material without any cost implication to Employer.

The specific methodology to be followed for above procurement through conversion route/BIS approved sources route shall be subject to approval by Employer in advance.

5.0 CW LINER/DUCT

The following tests / checks shall be carried out for CW Liner works:

A. Fabrication Works

SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
(I) CW Liner/ Pipes Fabricated using Steel Plates with Longitudinal & Circumferential Weld Joints at i) Site (Field Shop) or ii) Factory		
Option-1		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	100% for pipes up to 1200mm diameter
3.	DPT after back gouging	100% for pipes above 1200 mm diameter
4.	UT	Not recommended.
5.	RT	5%
6.	DPT on finished butt welds	10%
7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher.
Option-2		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	100% for pipes up to 1200mm diameter
3.	DPT after back gouging	100% for pipes above 1200mm diameter
4.	UT	Not recommended
5.	RT	- 100 % RT on circumferential joints in the bottom 1/3 portion of CW liner for weld length as per Fig 1 - 5% RT on top 2/3 portion of circumferential joints and - 5% RT on longitudinal joints
6.	DPT on finished butt welds	10%
7.	Hydro test	No Hydro test
(II) CW Liner/ Pipes Fabricated using H.R. coils with spiral weld joints at i) Factory		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	Not applicable
3.	UT	Not recommended.
4.	RT	5% RT
5.	DPT on finished butt welds	10% DPT
6.	Hydro test	Hydro test at 1.5 times the design pressure or 2 times the working pressure whichever is higher.

SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
B. Erection Works at site		
Tests for CW Liner erection at site		
1.	WPS, PQR& welder's Qualification	100%
2.	DPT on root run	100% for pipes unto 1200mm diameter
3.	DPT after back gouging	100% for pipes above 1200mm diameter
4.	UT	Not recommended.
5.	RT	5%
6.	DPT on finished butt welds	10%
7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher. In exceptional cases where hydraulic test is not possible the same may be substituted with 100% RT as per the instruction/discretion of EIC.

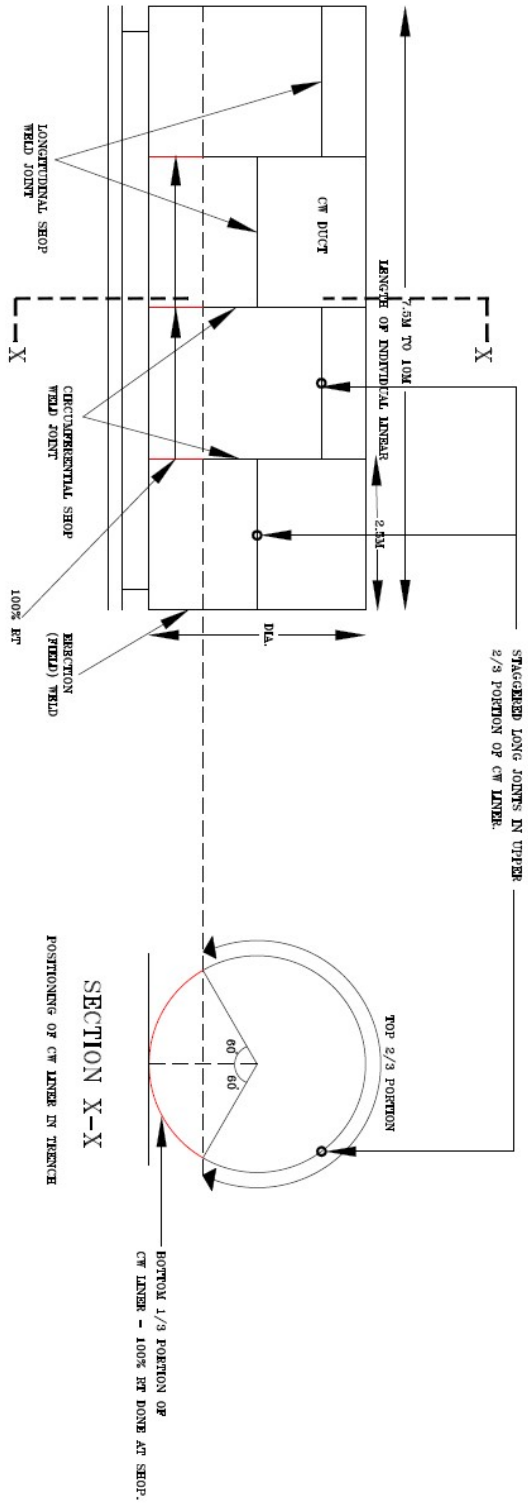

FIG.1 INDIVIDUAL PIECE OF CW LINER - RADIOGRAPHY TEST

NOTE : RADIOGRAPHED PORTIONS OF THE JOINTS TO BE SUITABLY COLOUR CODED FOR IDENTIFICATION DURING LAYING.

ANNEXURE - I

Format of Request Letter for Evaluation of Materials

Ref: _____ Date: _____

To,

Sub.: Evaluation of materials and concrete mix design

Dear Sir,

We have awarded the work of …… on M/s …….. vide our LOA No. ……. dated……for execution of Civil Works. Based on provisions of contract, M/s …….. are expected to get the following tests/ evaluation done through your laboratory and accordingly the tests have been described below.

M/s …… have been advised to deposit the requisite evaluation/ testing charges and to deliver the test samples of quantities, specified below.

1. Evaluation of Cement:

a) To carry out different physical tests on cement samples i.e. Blaine's fineness, initial and final setting time, soundness and compressive strength at 3, 7 and 28 days as per IS: 4031 and drying shrinkage and specific gravity in case of PPC.

b) To carry out chemical analysis of the cement samples as per IS: 4032, including the total alkali content of the cement (Na_2O equivalent).

c) To advise the suitability of cement based on the test results of a) and b) above.

2. Evaluation of Aggregates:

a) To carry out different tests on coarse aggregate sample i.e. specific gravity, water absorption, sieve analysis, deleterious material content (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale, Total of % of all deleterious materials), soundness, crushing value, impact value, abrasion value, elongation index and flakiness index, as per IS: 383 & IS: 2386.

b) To carry out different tests on fine aggregate sample i.e. specific gravity, water absorption, sieve analysis, soundness, deleterious material content (coal & lignite, clay lumps, material finer than 75-micron sieve, soft fragment, shale, Total of % of all deleterious materials), silt content, organic impurities and mica content as per IS: 383 & IS: 2386.

c) To prepare evaluation report based on test results of a) and b) above and to advise regarding suitability of fine and coarse aggregates to be used with the cement of 1) above.

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

a) To carry out petrographic analysis and Alkali-Aggregate Reactivity as per IS 2386 (PART VIII & VII).

b) If rock type is limestone, X-Ray diffraction test (XRD) shall be carried out to determine clay mineral in the rock for preliminary conclusions and to carry out repeated temperature cycle test to determine residual expansion of aggregate for concrete to be used in dynamic foundations like TG, Fans, mills, crushers etc. Additionally, Alkali carbonate reactivity test may be carried out wherein the parameters shall be reported in conjunction with the petrographic analysis.

c) To prepare a report based on test results of a) and b) above and to advise regarding suitability of aggregates to be used with the cement of 1) above and further testing required if any.

4. **Evaluation of Flyash Sample (if applicable):**

a) To carry out various physical and chemical tests on fly ash sample i.e. Blaine's fineness, lime reactivity, specific gravity, loss on ignition and other chemical tests as per IS: 3812, conforming to grade-I.

b) To advise the suitability of fly ash sample based on the test results of a) above.

5. **Evaluation of water:** To carry out various physical and chemical tests as per IS: 456 and IS:3025.

6. **Evaluation of admixtures:** To carry out various physical and chemical tests as per IS: 9103.

Note: Test certificate shall be obtained from the supplier to compare the values given in Table 2 of IS: 9103 i.e. uniformity tests and requirements.

7. **Concrete Mix Design:** Based on the provisions of technical specification, the Following may be specified by site Construction department/Quality department **

a) For RCC Work
- i. Grade of concrete :
- ii. Slump required, mm :
- iii. Cement- Type and grade :
- iv. Max Size of Aggregates, mm:
- v. Exposure conditions :
- vi. Maximum water-cement ratio:
- vii. Minimum cement content :
- viii. Concrete admixture to be used or not (If yes, specify the brand/ type/batch no. of admixture) :
- ix. Fly ash to be used or not (If yes, indicate % of fly ash to be used):

b) For PCC work: Same as i) to ix) of a) above

c) For piling work (if required): Same as i) to ix) of a) above

8. **Details of material sampled:** In order to facilitate the above mentioned tests, specified quantities of samples have been collected and sealed jointly (by Employer – Quality department, Execution department and contractors' representative) is being sent for testing. The impression of seal has also been punched below.

a) Quantity of material required for each mix-design:

Sl. No.	Material Description	Quantity Required
i)	Cement	2 bags (sealed in double polythene bags)
ii)	Coarse Aggregates	100 Kg of each fraction as explained below: e.g.; If Maximum size of aggregates (MSA) is 20mm, then 100 Kg each of 20-10mm and 10mm down are required. If MSA is 40mm then 100Kg each of 40-20mm, 20-10mm and 10mm down are required.
iii)	Fine Aggregates	200Kg
iv)	Chemical Admixtures	2 Litres
v)	Water	100 Litres
vi)	Fly ash (If decided to be used)	100Kg

b) Quantity of material required for Alkali-Aggregate reactivity

Sl. No.	Material Description	Quantity Required
i)	Coarse aggregate	
a)	80-40mm	60Kg
b)	40-20mm	60Kg
c)	20-10mm	60Kg
d)	<10mm	60Kg
ii)	Fine aggregates	60Kg
iii)	Cement	2 samples (1 bag each), contemplated for use in construction.

c) Impression/ Punch Mark of seal:

You are requested to kindly forward us the test reports along with the recommendations regarding the suitability of materials to us at the earliest.

Thanking you,

Yours faithfully,

Name:

Designation:

Contact Number:

Email ID:

(Quality department Representative of Employer)

Note:

1. Based on provisions of technical specification, the testing charges for all the above-mentioned tests shall be borne by the contractor.
2. The content of the letter is for guidance only, and if required may be suitably modified to suit the specific requirements of the package in consultation with Construction and quality department.

** This line may be deleted in the letter sent to the institute.

INDICATIVE FIELD QUALITY PLAN

Annexure II

SUPPLIERS NAME AND ADDRESS	**ITEM : Civil Work**	**QP NO. :**	**PROJECT:** SINGRENI THERMAL POWER PROJECT STAGE-II (1X800 MW)
		REV. NO. :	**PACKAGE:** EPC PACKAGE
	SUB-SYSTEM : GEOTECH INVESTIGATION, FOUNDATIONS, EXCAVATION & FILL, SITE LEVELLING, CONCRETE, ROAD, BUILDING/ ASH DYKE ETC.	**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	D*	Remarks
1	2	3		4	5	6	7	8	9		10
1	**GENERAL REQUIREMENTS**										
A	Setting up of Field QA&QC laboratory, Availability of requisite laboratory set up and equipment in good working condition & duly calibrated well before commencement of concerned activity.		As agreed / required	B	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings		SR	√	The contractor shall establish the mobilize the requisite laboratory equipment/set up and skilled QA&QC manpower within 30 days from the mobilization date of Main contractor at site. Functioning & calibration status of laboratory equipment in proper working condition to be verified on monthly basis.
B	Submission of QA & QC manpower deployment schedule and availability of manpower		As agreed / required	B	Physical	Manpower shall be deployed progressively as per the work front and discipline wise progress	Tech Specs and Const. Drawings		SR	√	
C	Sampling for testing of construction materials (Coarse aggregate, fine aggregate etc.), materials for concrete mix design etc.		As agreed / required	A	Physical	Once per each source	Tech Specs and Const. Drawings		SR/TR	√	Test report along with the recommendations from Owner acceptable laboratories to be submitted to EIC/FQA head for their review and acceptance.
D	Submission of Monthly Test/QA reports/data		As agreed / required	A	Physical	Monthly	Tech Specs and Const. Drawings		SR/TR	√	
E	Stacking and storage of construction materials and components at site		As per IS:4082	B	Physical	Random in each week	Tech Specs and Const. Drawings, Manufacturer's guidelines and IS 4082		SR		
F	Survey										
	Construction of Bench Mark / Grid Pillars	To mark reference co-ordinate & elevation	As required / agreed	B	Physical	Each Bench Mark/ Grid Pillars	As per technical specifications/approved drawings		SR	√	Joint protocol for co-ordinate and elevation
2	**EXCAVATION, FILLING/BACKFILLING AND COMPACTION WORKS**										
2.1	**Excavations-**										
i		Nature, type of soil/rock before and during excavations	As agreed / required	B	Visual/ Measurement	Random	Tech Specs and Const. Drawings/IS 1892		SR	√	GTI report to be referred. In case of ambiguity localised GTI may be carried out or excavation samples to be send to NTPC acceptable Third party lab for determination of soil/rock strata.
ii		Initial ground level before start of excavations, shape, Dimensions of excavations & Side slope of final excavation and Final excavation levels.	As agreed / required	B	Measurement	100%	Tech Specs and Const. Drawings		SR	√	
2.2	**Excavation in Hard Rock- If required**										
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	√	Owner 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 each shift	IS:4081, Tech Specs and Const. Drawings/		SR		
iii		Submission of Blasting report to EIC	As agreed / required	B	Physical	Each blast	Tech Specs and Const. Drawings			√	
iv		Excavation in Hard Rock (Blasting Prohibited)	As agreed / required	B	Physical	100%	As per approved drawing/ scheme, Tech Specs and Const. Drawings		SR	√	
2.3	**Filling/ Backfilling**										
i	Suitability of fill material	Grain size analysis, Organic Matter, Liquid Limit, plastic limit, Shrinkage limit & Free Swell Index and chemical analysis(like Organic Matter, Calcium carbonate, pH value, Total soluble sulphate etc.) as required in TS	As per IS: 2720	B	Physical	Once per each type of source or change of source subject to a min. of 2 samples	IS:2720 (Pt.IV), IS:2720 Pt.XXII, IS:2720 (Pt.XI)/relevant part, Tech Specs and Const. Drawings		SR/TR	√	Test report along with the recommendations regarding suitability of the fill material from NTPC acceptable laboratories to be submitted to EIC for review and acceptance. Geo technical investigation report may also be considered as basis for suitability of fill material if available as per the discretion of EIC.
2.4	**Standard proctor Test**	Optimum moisture content (OMC) and max. dry density (MDD) of filling/backfilling materials	As per IS: 2720	A	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Specs and Const. Drawings		SR/TR	√	
2.5	**Compaction of Filling / Backfilling Works**										
i	Moisture content	Moisture content of fill before compaction	As per IS: 2720	B	Physical	Random	IS 2720 (Pt.II), Tech Specs and Const. Drawings		SR/TR	√	
		Dry density by core cutter method ---- OR----				i) For foundation back fill: one in every 10 foundations for each compacted layer.	IS 2720 (Pt. XXIX)/				Number of readings for field density test may be decided by EIC according to the size of the soil bed which is subject to testing as the dry density of the soil varies

ii		Dry density in place by sand replacement method ---- OR---- any other method as per IS 2720	As per IS: 2720	A	Physical	ii) For area filling: every 1000 SQM area for each compacted layer.	IS 2720 (Pt. XXVIII)/ IS 2720 Relevant Part/ Tech Specs and Const. Drawings	SR / TR	√	testing as the dry density of the soil varies appreciably from point to point. However, in no case, readings should be less than three as compaction result drawn out of less than three readings may give erroneous result.
iii		Relative density (Density Index)	As per IS: 2720	A	Physical	----do----- (I) & (ii) above	IS 2720 (Pt. XIV), Tech Specs and Const. Drawings	SR/TR	√	
3	**RAW MATERIALS FOR CONCRETE**									
3.1	**CEMENT**									
i	Material	Physical and chemical properties as per relevant IS codes	As required/ agreed	A	Review of MTC/ test reports	for each manufacturing Week number	IS : 269/ IS:1489/ IS:455, Tech Specs and Const. Drawings	MTC	√	To be procured from BIS approved source having valid BIS License. Each consignment of cement shall be duly correlated with manufacturers' TC.
ii		Testing of cement for Setting time (Initial & Final) and compressive strength	As per IS:4031	A	Physical	one for each manufacturing Week number	IS : 269/ IS:1489/ IS:455, Tech Specs and Const. Drawings	SR/Test Report	√	Additionally, If the cement is stored more than 90 days in godown of contractor then the same shall be retested for Setting time & Comp. Strength.
3.1 b	**Fly ash (if applicable)**									
		Physical and chemical properties as per IS 3812 Part I (Table 1 and 2)	As per IS 3812 Part I	A	Physical	once in a week or change of source whichever is earlier	IS:3812 Part I and Tech. Spec./Design mix.	SR/Test Report	√	Batching plant shall have facility for mixing of fly ash.
3.2	**Coarse Aggregate**									
i		Moisture content	IS:2386	B	Physical	To be done every day before start of work	IS : 456/IS : 383/IS: 2386 Part-III/Tech Spec	SR/LB	√	During monsoon, frequency may be increased and accordingly water content in concrete will be adjusted.
ii		Sieve analysis, flakiness index, elongation index	IS:2386	B	Physical	One per 100 cum. or part thereof	IS: 2386 Part-I, IS:383 / Tech Spec	SR/LB/TR	√	
iii		Specific gravity, Soundness, Water absorption, Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale, Total of % of all deleterious materials),	IS:2386	A	Physical	Once for each source & for every change of source	IS: 2386 Part-III, IS: 2386 Part-II, IS: 2386 Part-V, IS:456, IS:383/Tech Spec	SR/LB/ TR	√	During Design mix, these tests may be carried out.
iv		Alkali aggregate reactivity and Petrographic examination	IS 2386	A	Physical	-do-	IS: 2386 (Part-VII/VIII), IS:383 /Tech Spec/ASTM C-1260 / ASTM 1293	SR/LB/ TR	√	
v		Crushing value, Abrasion value and Impact value	IS:2386	A	Physical	-do-	IS:383, IS-2386 Part IV/Tech Spec	SR/LB/ TR	√	
3.3	**Fine Aggregate**									
i		Moisture content	IS:2386	B	Physical	To be done every day before start of work	IS : 456/IS : 383/IS: 2386 Part-III/Tech Spec	SR/LB	√	During monsoon, frequency may be increased and accordingly water content in concrete will be adjusted.
ii		Sieve analysis, Silt content	As agreed / required	B	Physical	One per 100 cum. or part thereof	Tech Spec/ IS 2386 / IS 456/ IS 383	SR/LB/ TR	√	
iii		Specific gravity, Soundness, Water absorption, Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale, Total of % of all deleterious materials (excluded mica as well as included mica content)), organic impurities	IS:2386	A	Physical	Once for each source & for every change of source	IS: 2386 Part-III, IS: 2386 Part-II, IS: 2386 Part-V, IS:456, IS:383/Tech Spec	SR/LB/ TR	√	During Design mix, these tests may be carried out.
iv		Alkali aggregate reactivity and Petrographic examination	IS 2386	A	Physical	-do-	IS: 2386 (Part-VII/VIII), IS:383 /Tech Spec/ASTM C-1260 / ASTM 1293	SR/LB/ TR	√	
3.4	**Water**	Complete Testing as per IS:456-2000	As per IS:456	B	Testing	Once for each source and thereafter yearly in case of borewell. If water is used from open source like river, stream, canal etc., then water testing is to be done quarterly.	IS:456-2000/ Tech. spec.	TR	√	
3.5	**Admixtures for Concrete**	Material/Type of admixture and its suitability	As per IS:9103	A	Review of MTC/ test reports	For each lot received at site	As per Designed mix and IS:9103/ Tech. Spec.	Test Report/ MTC	√	Random sample may be send to Owner acceptable third party testing lab. for testing requirements as per TS and IS codes. Frequency of check may be decided by EIC/Head FQA based on quantity, requirement and Relevant IS code.
4	**CONCRETING (MIXING, CONVEYING, PLACEMENT, COMPACTION, CURING & TESTING)**									
4.1	**Batching Plant (if installed)**									

i		Calibration of Batching Plant		A	Physical	After initial setting up of batching plant, calibration by NABL accredited agency must be done before use of batching plant for production of concrete.	Review of calibration chart/ Certificate/IS 4925	Calibration Certificate	√	Additionally, Batching Plant shall be calibrated regularly at least once in a 3 months in-house. The weights for batching plant calibration to be calibrated once in year by NPL/NABL accredited lab /Weights & Measures Dept.
4.2	**CONCRETE**									
i		4 Trial mixes to ascertain the workability and cube strength	After receiving the recommended mix design	A	Physical	4 trial mix. for each mix proportion	Tech. Spec.,IS 456/IS 10262	SR/LB	√	The concrete for field trials shall be produced by methods of actual concrete production.
ii		Concrete Cube strength Test	IS:516	A	Physical	One set of 6 cubes per 50 Cum or part thereof for each grade of concrete per shift whichever is earlier.	IS:516, IS:456, Tech. Spec.	SR/LB/ 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.
iii		Workability - slump test	IS:1199	B	Physical	At the time of concrete pouring at site every two hrs.	IS:456/Tech. Spec.	SR/LB/ TR	√	
iv		Temperature Control of Concrete as per Tech. spec./IS standard	Thermometer	B	Physical	100%	Temperature as per technical specification/Relevant standard	SR	√	
v		Water Cement Ratio		B	Physical	For each batch of concrete	As per approved Design Mix	SR/Batch slip	√	
vi		Placement of concrete, Compacting, Curing	As required	B	Physical	At Random	IS:456, Period of curing as per IS 456	SR		
4.3	**TESTS / CHECKS ON RCC STRUCTURE IN HARDENDED CONDITION**									
i		Visual inspection of concrete surface just after removal of shuttering	As agreed / required	B	Visual	100%	As per IS:456/ tech. Specification.	SR		
ii		Dimensional check on finished structures	As agreed / required	B	Measurement	100%	As per IS:456/ tech. Specification and Const. Drawings	SR/LB	√	
iii		Position and alignment of embedded parts and inserts	As agreed / required	B	Visual	100%	As per provisions and tolerances of equipment supplier, Tech Specs and Const. Drawings			
iv		Embedment of inserts in concrete shall be checked for gap if any using hammer for all dynamic foundations	As agreed / required	B	Physical	100%	As per Technical Specification	SR	√	No hollow sound
v		Submission of grouting / repair methodology to EIC for approval if concrete surface / position and alignment of embedded parts / inserts are found defective	--	B	Review and approval	once for each type of defect	As per provisions and tolerances, Tech Specs and Const. Drawings		√	
vi		UPV Tests on top deck of TG foundation, Columns & Other Foundations as per Technical Spec.	IS:13311 / IS : 516	A	Physical	As per Tech. Spec.	IS:13311/ IS : 516/ As per Technical Specification	Test Report	√	
vii		Core Test	IS:516	A	Physical	As required by Owner EIC.	As per IS:456, IS 516	SR/LB/ TR	√	Compressive strength based on core test is required to be carried out in case of doubt regarding the grade of concrete used, either due to poor workmanship or based on the results of cube strength test as per 4.2 ii) above and as per discretion of EIC.
viii		Water Tightness Test of liquid retaining structure/ tanks	As required	A	Test	100%	IS:3370/ Tech. Specification	SR/LB	√	
5	**REINFORCEMENT STEEL AND ITS PLACEMENT**									
i	Material	Physical and chemical properties as per relevant IS codes and Tech spec.	As agreed/required	A	Review of MTC	Each batch/lot of delivery	As per IS 1786, IS 432, IS 1566, IS 13920 , Tech spec and cont. drawing	MTC	√	To be procured from Owner approved source.
	Coupler	Physical and chemical properties as per relevant IS codes and Tech spec.	As agreed/required	A	Review of MTC	Each batch/lot of delivery	IS 16172, Tech spec and cont. drawing	MTC	√	MTC shall contain all the parameters specified in the technical specifications
ii		Freedom from cracks surface flaws, Lamination & excessive rust.	As agreed / required	B	Visual	Random in each shift	IS: 1852, IS:432, IS:1786, Tech Specs and Const. Drawings	SR		To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs.
iii		Bar bending schedule with necessary lap, Spacers & Chairs	As agreed / required	B	Physical & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings, IS:2502	SR	√	
iv		Acceptance - disposition of cage w.r.t. reference axes, cover, spacing of bars, spacers and chairs after the reinforcement cage is put inside the formwork	Measuring tape & as required	B	Visual & Measurement	Random in each shift*	IS 456, Tech Specs and Const. Drawings	SR	√	* 'for foundations, frequency shall be Each foundation
6	**FOUNDATION SYSTEM**									
i		Foundation casting - Layout, Shape, dimensions, 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
7	**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		
ii		Soundness of staging, shuttering and scaffolding including application of mould oil / release agent	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. Drawings	SR		

iii		Acceptance of formwork before start of concreting : disposition w.r.t. reference axes, size, etc.	Measuring tape & as required	B	Physical / visual	Before start of each concreting	As per provisions and tolerances in IS 456, Tech Specs and Const. Drawings	SR	√	
8	**SLIPFORM SHUTTERING**									
i		Submission of Slip form Work system to be used	As required / agreed	B	Submission	Before Commencement of work	As per specifications	SR	√	
ii		Check for the Slip form shutters	As required / agreed	B	Physical	Before Commencement 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 Commencement of work	As per specifications	SR	√	
iv		Details of Proposed arrangement for continuous readings	-	B	Approval	Before Commencement of work	As per specifications	SR	√	
v		Check for All type of openings, Chases, Fixing of Blocks and similar built-up features	As required / agreed	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 EIC shall be executed in the concrete.
vi		Details of proposed method for concrete curing and protection	-	B	Approval	Before Commencement of work	Construction Drawings and specifications	SR	√	Submitted to EIC for approval
vii		Check of Concrete Curing and Protection	As required / agreed	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 & Monitoring of Sliding Portion	As required / agreed	B	Physical	Each Sliding	As per specifications	SR		Rate of Sliding, Delays in sliding, Discontinuity or stop start sliding to be checked
ix		Progress Height	As required / agreed	B	Physical	Once per shift	As per specifications	SR	√	
x		Centre line in relation to the centres at the base	As required / agreed	B/A	Physical	Min. once per shift/ Min. once per day	As per specifications	SR	√	
xi		Internal wall faces in relation to the concrete at the base	As required / agreed	B	Physical	Once per shift	As per specifications	SR		
xii		Wall thickness	As required / agreed	B	Physical	Once per shift	As per specifications	SR	√	To be recorded in tabular form and on graphs immediately after each monitoring
xiii		Twist	As required / agreed	B	Physical	Once per shift	As per specifications	SR	√	
xiv		Verticality of the structure	As required / agreed	B/A	Physical	Every day in morning/ Random	As per specifications	SR	√	
xv		Check for Tolerances for chimney construction	As required / agreed	B	Physical	For every day monitoring	As per specifications	SR	√	
9	**EMBEDDED PARTS (INCLUDING LAYING OF RAILS & ANCHOR FASTENERS) --If Applicable.**									
i		Material	As agreed / required	B	Review of MTC/ test reports	Each batch/lot of delivery	As per Tech Specs and Const. Drawings	SR/MTC	√	
i		Position / alignment / levels of embedded parts / bolt hole / pipe sleeves / rails / PVC pipes / etc. as per TS and construction Drg.	As agreed / required	B	Physical/ measurement	100%	As per Tech Specs and Const. Drawings	SR/ Protocol	√	Exposed surface of the embedded parts other than holding down bolts are to be painted with as per technical specifications.
ii		Welding / tying of embedment to reinforcement	As agreed / required	B	Physical/ measurement	Random in each shift	As per Tech Specs and Const. Drawings	SR		
10	**JOINTS IN CONCRETE, DAMP PROOF COURSE**									
i	JOINTS IN CONCRETE	Joint material - bitumen impregnated fibre board, PVC water stops, Sealing compound, Expanded polystyrene board, Hydrophilic strip, Acrylic polymer etc. (as given in technical spec)	As per manufacturer Standards	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings, IS 1838, IS 1834, IS12200	SR/MTC	√	
ii	DAMP PROOF COURSE	Material - Hot bitumen and water proofing materials etc. (as given in technical spec).	As agreed / required	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings, IS 702	SR/MTC	√	
iii		Acceptance of installation of Joints material & Acceptance of damp proof course.	As agreed / required	B	Acceptance	Each installation randomly	Tech Specs and Const. Drawings		√	
11	**GROUTING**									
i		Material	As agreed / required	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR//MTC	√	
ii		Compressive strength of grouting material before its use.	As agreed / required	A	Physical	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR/LB/ TR	√	
iii		Compressive strength of cubes after grouting.	As agreed / required	A	Physical	Random	Tech Specs and Const. Drawings	SR/LB/ TR	√	
iv		Acceptance of the grouts : Mixing, placement, application and grout pressure (as applicable)	As agreed / required	B	Physical	Each grout section	Tech Specs and Const. Drawings	SR	√	

12	**MASONARY WORKS**										
12.1	**Test on Bricks**										
i		Compressive strength, water absorption, efflorescence.	As agreed / required	A	Measurement/ Physical Test	As per relevant IS Code/ One Sample for 30,000 nos. or part thereof	IS: 1077, IS:13757, IS: 12894 / Tech Specs and const. Drawings		SR/LB/ TR	√	
ii		Dimensions , shape, warpage.	As agreed / required	B	Measurement/ Physical Test	As per relevant IS Code/ One Sample for 30,000 nos. or part thereof	IS: 1077, IS:13757, IS: 12894 / Tech Specs and const. Drawings		SR/LB	√	Warpage test is applicable for facing bricks only as per IS:2691.

12.2	**Modular aerated panel**									
i	**Material**	As required	As agreed / required	A	Review of test report	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR/LR	√	
12.3	**Autoclaved Aerated Concrete (AAC) block**									
i		Material	As agreed / required	B	Review of MTC	Each batch/lot of delivery	Tech Specs /IS 2185 Part III and Const. Drawings	SR/MTC	√	
ii		Compressive Strength and Density	As agreed / required	A	Physical	As per relevant IS Code/ One Sample for 10,000 nos. or part thereof	Tech Specs /IS 2185 Part III	TR	√	
iii		Dimensions, shape	As agreed / required	B	Physical	As per relevant IS Code/ One	Tech Specs /IS 2185 Part III	TR/SR	√	
12.4	**Test on Mortar**									
i	Sand	Grading	As agreed / required	B	Test	once per 100 Cum or part thereof	IS:2116	SR/LB	√	
ii		Compressive strength	As agreed / required	B	Test	At random	IS 2250-1981, Tech Specs and Const. Drawings	SR/TR	√	
12.5	**Masonry construction**	Workmanship, verticality and alignment	As agreed / required	B	Visual/ Physical	100%	IS 2212, IS 1905 , Tech Specs and Const. Drawings	SR/LB		
13	**PLASTERING- MATERIAL AND WORKMANSHIP**									
i	Sand	Deleterious Material	As agreed / required	B	Physical	Once per source	IS : 2386 (Part-I &II) & IS :2116, Tech Specs and	SR/TR	√	
ii		Grading	As agreed / required	B	Physical	50 Cum./or part thereof	Tech Specs and Const. Drawings	SR/TR	√	
iii		Silt content	As agreed / required	B	Physical	One per 100 cum., or part thereof	CPWD/ Tech Spec/ IS 2386/ IS 456/ IS 383	SR/LB/ TR	√	
iv	Stone grit plaster/ granular textured coat finish (if applicable)	Material	As agreed / required	B	Review of MTC	For each lot received at site	Tech Specs and Const. Drawings	SR/MTC	√	
v	**Galvanised wire mesh (if applicable)**	Galvanized hexagonal wire netting for lath plastering	As agreed / required	B	Review of MTC/ test reports	Each batch/lot of delivery at site	Tech Specs and Const. Drawings	SR/MTC	√	
vi		Thickness, Trueness and finishing of plaster, grooves etc.	As agreed / required	B	Visual/ Measurement	Random in each shift	Tech Specs and Const. Drawings	SR/LB	√	
14	**PAINTING SYSTEM - CONCRETE WORKS (including Chimney) AND PLASTERED MASONARY SURFACES**									
i	Materials and accessories- Oil Bound, Acrylic Emulsion, Chemical Resistant, Oil Resistant Paint etc. as applicable (as given in technical spec).	Shade, type from brand and manufacturer as approved by EIC.	As agreed / required	A	Review of MTC/ test reports	Each batch/lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
ii	Surface preparation	As required	As agreed / required	B	Physical / visual	Random in each shift	Tech Specs and Const. Drawings	SR		
iii	Acceptance of painted surfaces	Shade, finish, WFT	As agreed / required	B	Physical/visual	Each surface at random	Tech Specs and Const. Drawings	SR	√	
14.2	**PAINTING SYSTEM - STEEL WORKS (OTHER THAN STRUCTURAL STEEL WORKS)**									
i		Painting Materials and accessories	-	A	Review of MTC/ test reports	Each batch of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
ii		Surface preparation	As agreed / required	B	Physical / visual	Each Erection Mark	Tech Specs and Const. Drawings, Relevant code/ standards	SR	√	
iii		Primer Thickness	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	√	
v		Acceptance of painted surfaces : DFT, Finish, Shade	Elcometer	B	Visual and measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	√	
15	**SHEETING, INSULATION & ALLIED WORK**									
i		Material : Profiled Colour coated Metal Deck & Cladding sheets	As agreed / required	A	Review of CHP/ Test reports	Each lot received at site	Tech Specs and/ Const. Drawings/ profiled drawing	CHP/TR	√	Co-relation with CHP/TR (Video-jet printing or coil no. or any other means) may be verified with the lot received at site.
ii		Insulation material (other than Chimney insulation), galvanized wire net, aluminium foil, fasteners	As agreed / required	A	Review of MTC/ test reports	Each lot received at site	Tech Specs and/ Const. Drawings	SR / LB/MTC	√	All tests as per specification
iii		Insulation material (for Chimney insulation)	As agreed / required	A	Review of MTC/CHP/MDCC reports	Each lot received at site	Tech Specs and/ Const. Drawings	MTC/CHP/ MDCC/Inspection report	√	
iv		Installation, lap alignment & workmanship.	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and/ Const. Drawings	SR		No gas cutting of colour coated sheets acceptable .
v		Finishing and acceptance	As agreed / required	B	Visual/ Physical	Each installation	Tech Specs and/ Const. Drawings	SR/LB	√	
16	**DOORS , WINDOWS, VENTILATORS & GRILLS**									
i	Steel doors	Materials & Check for shape tolerances thickness, welding & finishing of sections as per TS	As agreed / required	B	Visual/ Physical / test report	For each lot received at site	Tech Specs and Const. Drawings	SR / LB/TR	√	Review of test report
ii	Wood/Timber	Moisture content & anatomy	As agreed / required	A	Physical	For each lot received at site	Tech Specs and Const. Drawings/ IS 287	SR/LB	√	Tests to be carried out from Owner acceptable third party lab. like Forest Research Institute Dehradun. Frequency of check may be decided by EIC based on quantity and requirement.
iii	Wood work in frames	Check for dimensions, surface finish	As agreed/ required	B	Physical	Random for each installation	Tech Specs and Const. Drawings	SR	√	

iv	Flush Door shutter	End emersion test, knife test, adhesion test	As agreed/ required	A	Review of MTC/test reports	For each lot received at site	IS 2202, Tech Specs and Const. Drawings	SR/MTC	√	The required tests to be carried out from Owner acceptable third party lab. like Forest Research Institute Dehradun in addition to review of MTC/TR. Frequency of check may be decided by EIC based on quantity, requirement and IS 2202.
v	Particle Door		As agreed / required	A	Review of MTC/ test reports	For each lot received at site	IS:12823, Tech Specs and Const. Drawings	SR/MTC	√	The required tests to be carried out from Owner acceptable third party lab. like Forest Research Institute Dehradun in addition to review of MTC/TR. Frequency of check may be decided by EIC based on quantity, requirement and IS 12823.
vi	Anodised aluminium works (Door & Window)	Materials- Aluminium sections, Coating	As agreed / required	A	Visual/ Physical / test report	For each lot received at site	IS: 1948, IS: 1949, IS:733, IS1285, IS:1868, IS:11857/ Tech Specs and Const. Drawings	SR / LB	√	Randomly one sample of each type may be send to Owner acceptable third party testing lab. for testing requirements as per TS and IS codes. Anodization shall be as per Tech. Spec. Frequency of check may be decided by EIC based on quantity, requirement and relevant IS code.
vii	Fire proof doors	Material & Receipt inspection	As agreed / required	A	Review of MTC/ purchase order (unpriced copy) / drawings of suppliers / certificate of CBRI/CPRI/GOV. LAB. & Visual/ Physical/ Review of MTC	For each source & For each lot received at site	Tech Specs and Const. Drawings	SR/MTC	√	The door drawing proposed for supply should have been tested and approved by CBRI Roorkee/CPRI/GOV. LAB. for the similar dimensions for minimum fire rating as required in Tech. spec.
viii	Rolling shutters	Surface finish and thickness of plate of approved make and DFT	As agreed / required	B	Physical / visual / review of MTC	Random for each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
ix	Steel windows / Grills/ Louvre	Material fabrication and fixtures	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	IS: 1038 / IS:1361, IS: 7452 and Tech Specs and Const. Drawings	SR/MTC	√	
x	Doors / Windows Sections	Material - Rolled Steel, Z Sections, T-iron frames sections, Plates etc.	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	
xi	Glass and glazing, Reflective toughened glass as per TS.	Material	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	IS: 14900, IS:1081, IS: 3548, IS:5437 Tech Specs and Const. Drawings	SR/MTC	√	
xii	Curved dome on roof/ Poly Carbonate Sheet	Materials - As per tech spec.	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	Randomly one sample of each type may be send to Owner acceptable third party testing lab. for testing requirements as per TS and IS codes. Frequency of check may be decided by EIC based on quantity, requirement and Relevant IS code.
xiii	False Ceiling	Materials - As per tech spec.	As agreed / required	A	Review of MTC/ test reports	For each lot received at site	Tech Specs and Const. Drawings	SR/MTC	√	Randomly one sample of each type may be send to Owner acceptable third party testing lab. for testing requirements as per TS and IS codes. Frequency of check may be decided by EIC based on quantity, requirement and Relevant IS code.
xiv		Installation finishing and acceptance	As agreed / required	B	Visual / physical	Random	Tech Specs and Const. Drawings	SR		
17	**WATER PROOFING (Roof / Basement Treatment)**									
i		Methodology for the application of water proofing system	As required	B	Review	for each type of treatment	Tech Specs and Const. Drawings	SR	√	
ii	Graded under bed	Levels / slopes	As required	C	Physical	100%	Tech Specs and Const. Drawings			
iii	Elastomeric coatings	Material- Primer coat, finishing coat	As required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
iv	Wearing course	Materials - As per tech spec.	As required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
v		Acceptance of water proofing work	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings			
18	**Fencing and Gates**									
i	PVC coated chain link fencing (IS 2720), Welded wire mesh (IS 1566), Reinforced barbed tape galvanised (IS 2629) etc.	Materials	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
ii	Structural steel, painting system, caster wheel, ball and bearing, fixtures and fasteners	Materials	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications

iii		Alignments, erection painting, DFT etc. and acceptance of the installation and working	As agreed / required	B	Physical / measurements	Each installation	Tech Specs and Const. Drawings	SR	√	
19	**FLOOR FINISHES AND ALIED WORKS**									
i	Cement Concrete Flooring	Glass/ PVC strips in joints	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings	SR		
ii	Ceramic tiles, vitrified tiles, glass mosaic, acid alkali resistant tiles, heavy duty cement concrete tiles (Materials as per TS)	Materials	As agreed / required	B	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications. In case non-availability of MTC, sample to be tested as per relevant IS code.
iii	Interlocking Blocks	Materials	As agreed / required	A	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
iv	Kota Stone, Granite and Marble	Materials: Quality, texture, thickness, colour for each lot of delivery	As agreed / required	B	Physical	Each lot of delivery	Tech Specs/ BOQ and Const. Drawings	SR/TR	√	
v	Metallic / non-metallic hardener	Material	As agreed / required	B	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	
vii	Acid / alkali and oil resistant high built seamless epoxy based resin and treatment	Material	As agreed / required	A	Review of MTC / test reports	Each lot of delivery	Tech Specs and Const. Drawings	TR/MTC	√	work to be done by skilled manpower
		Surface preparation (as applicable)	As agreed / required	B	Physical	Random in each shift	Tech Specs and Const. Drawings, IS 2395			
viii	Rubber Flooring	Material	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings / IS 809	TR/MTC	√	MTC shall contain all the parameters specified in the technical specifications
ix		Finishing and acceptance of all above BOI	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings	SR		
20	**WATER SUPPLY / SANITORY INSTALLATIONS**									
i	Material	Sanitary items and fixtures i.e. water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap containers, geyser, water cooler, etc, water supply / sanitation pipes (GI/ MS/ SCI/ CI / RCC), manhole cover and frames, Over head / loft type etc. as per TS	As agreed / required	B	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	
ii		leakage of pipes	As agreed / required	B	Physical	Each installation	Tech specs and const drawings	SR	√	
iii		Acceptance of installations of all sanitary items and fixtures	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings	SR		
20.2	**RCC Pipes**									
i	Material (As per TS)	RCC pipes	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	To be procured from BIS Approved Sources having valid BIS License.
ii		Acceptance and leakage	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR		
20.3	**Water Storage Tanks**									
i	Material (As per TS)	Over head / loft type	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	To be procured from BIS Approved Sources having valid BIS License.
ii		Acceptance and leakage	As agreed / required	B	Acceptance	Random	Tech Specs and Const. Drawings	SR		
21.0	**SPECIAL ITEMS**									
21.1	**Earthing Mat (Grounding System)**									
i	Material (As per TS)	Earthing mat	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043	SR/TR/MTC	√	
ii		Weld sizes & length	Visual/Tape	B	Visual/ Measurement	100%	Tech Specs and Const. Drawings			Owner 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	100%	Tech Specs and Const. Drawings,	SR/TR	√	
21.2	**Bitumen layer for tank foundation**									
i	Material (As per TS)	Grade of bitumen	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	As per relevant IS and Tech. Specs /MTC	SR/MTC	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii	Acceptance and workmanship	Application / workmanship	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR		
21.3	**Composite Aluminium Panels and structural glazing**									
i	Material (As per TS)	Type of aluminium panels / structural glazing / fasteners and fixtures / silicon sealant	As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Technical specifications / drawings	SR/TR/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		

21.4	**Pressure Release Valves**									
i	Material (As per TS)		As agreed / required	A	Review of MTC/ test reports	Each lot of delivery	Technical specifications / drawings	SR/TR/MTC	√	
ii	Acceptance and workmanship	Acceptance / Installation / workmanship	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR	√	
21.5	**ANTI WEED TREATMENT**									
i	Material (As per TS)	Anti-weed treatment materials	As agreed / required	B	Review of MTC/ test reports	Each batch of delivery	Tech Specs and Const. Drawings	SR/TR/MTC	√	
ii		Execution of treatment	As agreed / required	B	Physical	Random check for each treatment	Tech Specs and Const. Drawings	SR		
23	**PILING WORK (If Applicable)**									
23.1	**Execution**									
i		Borehole diameter	As required	B	Physical	100%	As per appd. Drawings and technical specification	SR/LB	√	
ii		Pile layout	Total station	B	Measurement	100%	As per appd. Drawings and technical specification	SR/LB	√	
iii		Recording ground level and pile termination level	As required	B	Measurement	Random	As per appd. Drawings and technical specification	SR/LB	√	
iv		Cleaning/Flushing of pile bore	As required	B	Measurement	Each pile	IS 2911/ Tech. Specs.	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.(if applicable)	As required	B	Measurement	100%	As per appd. Drawings and technical specification	SR/LB	√	
vi		Pouring of concrete to project above cut off level.	As required	B	Measurement	100%	As per appd. Drawings and technical specification	SR/LB	√	
23.2	**Testing**									
i		Bentonite	IS:2720	A	Physical / Test report	Once per lot	As per IS:2720, IS 2911/ tech. Specs.	MTC/TR	√	One sample from each source (brand/manufacturer) to be tested at Owner acceptable third party lab.
ii		Density check on sample of mud collected from pile bore bottom	IS 2911	B/A	Physical	Each pile/ Randomly 1 in 10 piles (i.e. 10%)	IS 2911/ Tech. Specs./approved PILING METHODOLOGY	SR/LB	√	Tests to be done before placing of concrete.
ii		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/TR	√	
iii		Concrete Cube strength Test	IS:456	A	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/TR	√	
iv		Initial pile load test, Vertical (Compression), Lateral (horizontal) and pull-out (tension).	IS:2911 / as required	A	Testing	As per Technical Specification/IS standard	IS:2911, As per appd. Drawings and technical specification	SR/LB/TR	√	
v		Routine pile tests (VERTICAL LOAD TEST (COMPRESSION) and LATERAL LOAD TEST (horizontal))	IS:2911 / as required	A	Testing	As per Technical Specification/IS standard	IS:2911, As per appd. Drawings and technical specification	SR/LB/TR	√	
vi		Pile Integrity Tests (PIT)	PEM / as required	A	Testing	100%	IS:2911, As per appd. Drawings and technical specification and suppliers manual	Test Report	√	
22.0	**GEOTECHNICAL INVESTIGATION WORK**									
i		Deployment of Owner approved Geotechnical Investigation Agency - Equipment, Manpower etc.	As required / agreed	B	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	√	
ii		Execution of Geotechnical Investigation - locations, type etc. as per scheme	As required / agreed	B	Physical	Each Location	As per technical specifications , approved drawing and relevant IS Codes	SR	√	
iii		Collection of disturbed and undisturbed samples , their packing and storage	As required / agreed	B	Physical	each sampling	As per technical specifications , approved drawing and relevant IS Codes	SR		
iv		Conducting filed tests as per investigation scheme- such as, SPT/ERT/SCPT/PLT/PMT etc. if applicable	As required / agreed	B	Physical	each field test	As per technical specifications , approved drawing and relevant IS Codes	SR	√	
v		Submission of Owner approved Final Geotechnical investigation report along with recommendations.	As required / agreed	B	Physical	After completion of investigation work	As per technical specifications and relevant IS Codes	-	√	

23	**ROAD WORKS**									
23.1	**Tests on Embankment, Subgrade Construction and Cut Formation**									
A)	**Suitability of Borrow Fill material**									
i		Sand Content	As per IS 2720	A	Physical	Once per each type of source or change of source subject to a min. of 2 samples	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part IV)	SR/TR	√	
ii		Plasticity Test	As per IS 2720	A	Physical	Once per each type of source or change of source subject to a min. of 2 samples	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part V)	SR/TR	√	
iii		Density Test	As per IS 2720	A	Physical	Each soil type to be tested, 2 tests	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part VIII)	SR/TR	√	
iv		Deleterious Content Test	As per IS 2720	B	Physical	As and when required by Engineer in charge	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XXVII)	SR/TR	√	
v		Moisture Content Test	As per IS 2720	A	Physical	Two Tests	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part II)	SR/TR	√	
vi		CBR Test	As per IS 2720	A	Physical	One CBR test (Avg. of three specimens) or closer as and when required by EIC	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XVI)	SR/TR	√	
vii		Free swell Index	Measuring Cylinder	A	Physical	Once per each type of source or change of source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Part XI)	SR/TR	√	
B	**Compaction**									
i		Standard proctor Test	As per IS: 2720	A	Physical	One in every 2000 cum for each type and source of fill materials	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Pt.VII)	SR/TR	√	
ii		Moisture content of fill before compaction	As per IS: 2720	B	Physical	Random	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Pt.II)	SR/TR	√	
iii		Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720	A	Physical	One in every 2000 SQM area for each compacted layer.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 2720 (Pt. XXIX)/ IS 2720 (Pt. XXVIII),	SR/TR	√	
iv		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.2	**Granular Sub-Base (GSB) (if applicable)**									
i		Grading of aggregate	Set of IS Sieves	B	Physical	One test per 400 cum	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
ii		Atterberg limits	Atterberg limits determination	A	Physical	One test per 400 cum	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iii		Moisture Content prior to compaction	As required / agreed	B	Physical	One test per 400 cum	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Density of compacted Layer	As required / agreed	B	Physical	one test per 1000 sqm.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
v		Deleterious Constituents	As required / agreed	B	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
vi		CBR	As required / agreed	B	Physical	As required	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.3	**Water Bound Macadam (WBM)**									
i		Aggregate Impact Value	Aggregate Impact value Test Apparatus	A	Physical	One test per 1000 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
ii		Grading of aggregate	Set of IS Sieves	B	Physical	One test per 250 cum	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
iii		combined Flakiness and Elongation Indices	Flakiness & Elongation test gauge	B	Physical	One test per 500 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iv		Atterberg limits of binding material	Atterberg limits determination	A	Physical	One test per 50 cum of binding material	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
v		Atterberg limits of screenings	Atterberg limits determination	A	Physical	One test per 100 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
23.4	**Wet Mix Macadam (WMM) for base course and sub-base course**									
i		Aggregate Impact value	Aggregate Impact value Test Apparatus	A	Physical	One test per 1000 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
ii		Grading of aggregate	Set of IS Sieves	B	Physical	One test per 200 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iii		Combined Flakiness index and elongation index	Flakiness & Elongation test gauge	B	Physical	One test per 500 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	
iv		Atterberg Limits of portion of aggregate passing 425 micron sieve	Atterberg limits determination	A	Physical	One test per 200 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	

v		Density of compacted Layer	As required / agreed	B	Physical	one set of three tests per 1000 sqm.	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification,	SR/TR	√	Template, straight edge
23.5	**Premix Bituminous Macadam (BM)**									
i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii		Aggregate Impact Value / Los Angeles Abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	A	Physical	One test per 200 cum of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iii		Combined Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	B	Physical	One test per 350 cum for each source	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Stripping value of aggregate (Immersion tray test)	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
v		Water absorption of aggregate	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vi		Water sensitivity of mix	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vii		Grading of aggregates	Set of Sieves	B	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
viii		Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
ix		Percentage of fractured faces	As required / agreed	B	Physical	one test per 100 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
x		Binder content	Bitumen extractor	A	Physical	Periodic, subject to a min of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xi		Control of Temperature of binder and aggregate for mix and of the mix at the time of laying and rolling	Thermometer	B	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xii		Rate of spread of mixed materials	As required / agreed	B	Physical	At Regular Interval	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.6	**Bituminous Concrete**									
i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73 or IRC:SP:53, IS:15462	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii		Aggregate Impact Value / Los angels abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	A	Physical	One test per 350 cum of aggregate for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iii		Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	B	Physical	One test per 350 cum of aggregate for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Soundness Test (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
v		Water absorption of aggregate	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vi		Sand equivalent test	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vii		Plasticity Index	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
viii		Polished stone value	As required / agreed	B	Physical	One test for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
ix		Percentage of fractured faces	As required / agreed	B	Physical	One test per 350 cum of aggregate when crushed gravel is used	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
x		Mix Grading	Set of Sieves	B	Physical	One set for individual constituent and mixed aggregate from dryer for each 400 tonnes of mix subject to minimum of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	

xi		Stability and voids analysis of mix including theoretical maximum specific of loose mix	As required / agreed	B	Physical	Three tests for stability, flow value, density and void contents for each 400 tonnes of mix subject to minimum of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xii		Moisture Susceptibility of mix (AASHTO T283)	As required / agreed	A	Physical	One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xiii		Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	Thermometer	B	Physical	At regular intervals	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xiv		Binder content	Bitumen extractor	A	Physical	One set for each 400 tonnes of mix subject to minimum of two tests per day per plant	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
xv		Rate of spread of mixed materials	As required / agreed	B	Physical	After every 5th truck load	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
xvi		Density of compacted Layer	As required / agreed	A	Physical	One test per 700 Sqm of area	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
		Lines, grade and cross section	As required / agreed	B	Physical	One in every 500 SQM area	As per Tech Specs and Const. Drawings	SR		Template, straight edge
23.7	**Premix surfacing and Seal coat**									
i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification, IS 73	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii		Aggregate Impact Value / Los Angeles Abrasion value	Aggregate Impact Value/Los Angeles Test apparatus	A	Physical	One test per 200 cum of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iii		Combined Flakiness Index and elongation index of aggregates	Flakiness & Elongation test gauge	B	Physical	One test per 100 cum of aggregate for each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
iv		Stripping value of aggregate (Immersion tray test)	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
v		Water absorption of aggregate	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vi		Grading of aggregates	Set of Sieves	B	Physical	Two test per day per plant both on individual constituents and mixed aggregate from dryer	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
vii		Soundness (Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
viii		Polished stone value	As required / agreed	B	Physical	one test of each source and whenever there is change in the quality of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
ix		Temperature of binder at application	Thermometer	B	Physical	At regular interval	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
x		Binder Content	Bitumen extractor	A	Physical	Two tests per day per plant	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
xi		Percentage of fractured faces	As required / agreed	B	Physical	One test per 100 cum of aggregate	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	
23.8	**Tack Coat/ Prime coat**									
i		Quality of binder	As required / agreed	A	Physical	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable	IS 73,Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR	√	APPROVED SOURCE FOR MATERIAL PROCUREMENT SHALL BE ALL GOVERNMENT REFINARIES
ii		Binder temperature for application	Thermometer	B	Physical	At regular close intervals	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
iii		Rate of spread of binder	As required / agreed	B	Physical	Three tests per day	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
23.9	**RCC pavement/ PQC/ Geopolymer Concrete**									
	Quality checks for Materials used for Pavement concrete		As per Table 900-6 of MORTH Spec.							
	Quality checks for concrete used for Pavement concrete		As per Table 900-6 of MORTH Spec.							
23.10	**Alignment, Level, Surface regularity and rectification**									
i		Horizontal alignment, Surface levels and Surface regularity	As required / agreed	B	Physical	As per section 900 of MOSRTH specification	As per Tech Specs and Const. Drawings, Section 900 of MOSRTH specification	SR/TR		
ii		Rectification	As required / agreed	B	Physical	Each rectification	As per Tech Specs and Const. Drawings, Section	SR/TR	√	
24	**Raw Water Reservoir and Ash Dyke**									
A	**Preparation of foundation surface**									
i		For embankment foundations	Visual	B	Physical	100%	IS:2720 & Tech. Spec.	SR/TR		The foundation shall be free from all organic material, vegetables and weak layers of compressive materials as per Technical spec.
B	**Compaction of Filling / Embankment Works**									

i	Suitability of fill material (if applicable)	Grain size analysis, Organic Matter, Liquid Limit, plastic limit, Shrinkage limit & Free Swell Index and chemical analysis(like Organic Matter, Calcium carbonate, pH value, Total soluble sulphate etc.) as required in TS	As per IS: 2720	B	Physical	Once per each type of source or change of source subject to a min. of 2 samples	IS:2720 (Pt.IV), IS:2720 Pt.XXII, IS:2720 (Pt.XI)/relevant part, Tech Specs and Const. Drawings	SR/TR	√	Test report along with the recommendations regarding suitability of the fill material from NTPC acceptable laboratories to be submitted to EIC for review and acceptance. Geo technical investigation report may also be considered as basis for suitability of fill material if available as per the discretion of EIC.
ii	**Standard proctor Test**	Optimum moisture content (OMC) and max. dry density (MDD) of filling/backfilling materials	As per IS: 2720	A	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Specs and Const. Drawings	SR/TR	√	Frequency may be modified by EIC as per the requirement.
iii	Moisture content	Moisture content of fill before compaction	As per IS: 2720	B	Physical	Random	IS 2720 (Pt.II), Tech Specs and Const. Drawings	SR/TR	√	
iv	**In-situ Dry Density**									
a	For foundation surface compaction			A	Physical	Once for every 250 metre length	IS: 2720 , Technical Specification and Construction Drawing	SR/TR	√	
b	For cut off trench and core shell			A	Physical	Once for every 250 metre length in each layer separately	IS: 2720 , Technical Specification and Construction Drawing	SR/TR	√	
c	for Embankment filling & compaction works			A	Physical	i) Once for every 250 metre length of Embankment in each layer (layer of compacted thickness as given in Technical spec./BOQ.) ii) Once for every 50 metre width of Embankment or part thereof in each layer separately	IS: 2720 , Technical Specification/BOQ and Construction Drawing	SR/TR	√	
d	For trimmed slope (both side)			A	Physical	Once for every 250 metre length of Embankment	IS: 2720 , Technical Specification and Construction Drawing	SR/TR	√	
C	**Permeability**		As per Relevant IS	A	Physical	Once for every 5000 cum for cut off trench , core and/or as per requirement of Technical spec./BOQ	IS: 2720 , Technical Specification/BOQ and Construction Drawing	SR/TR	√	
D	**Embankment Geometry/ Dyke Geometry**									
i		Top width	As per Tech. Spec.	B	Physical	Once for every 100 metre length of trimmed completed Embankment.	Technical Specification and Construction Drawing	SR/TR	√	
ii		Outer Slope	As per Tech. Spec.	B	Physical	--do--	Technical Specification and Construction Drawing	SR/TR	√	
iii		Inner Slope	As per Tech. Spec.	B	Physical	--do--	Technical Specification and Construction Drawing	SR/TR	√	
E	**Coarse Aggregate for aggregate filters**									
i		check for gradation	IS: sieves	B	Physical	Once for each stack and each change of source	for aggregate filter gradation meeting the filter criteria as per Technical Specification.	SR/TR	√	
ii		specific gravity	pycnometer	B	Physical	Once for each stack and each change of source	IS:2386 Part I, and IS:1122 and Technical Specification	SR/TR	√	
iii		crushing value	as required	B	Physical	Once for each source	IS:2386 Part IV Technical Specification	SR/TR	√	
iv		soundness	Chemicals, balances etc.	B	Physical	Once for each source	IS:2386 Part V , IS:1126 Technical Specification	SR/TR	√	
v		impact value	as required	B	Physical	Once for each source	IS:2386 Technical Specification	SR/TR	√	
vi		water absorption	weight balance etc.	B	Physical	Once for each source	IS:2386 Technical Specification	SR/TR	√	
F	**Sand/ Bottom Ash for filters blanket and chimney**									
i		gradation- grain size analysis	sieve set	A	Physical	once for every 10000 cum or change of source whichever is earlier	for sand filter gradation meeting the filter criteria as per Technical Specification.	SR/TR	√	
ii		specific gravity	pycnometer	A	Physical	Once for each source	IS:2386 part I and Technical Specification	SR/TR	√	
iii		Filter criteria	relevant IS Codes	A	Physical & Lab Test	once for every 10000 cum or change of source whichever is earlier	IS:9429 and Technical Specification	Lab. TR	√	
iv		Silt Content	as required	B	Physical	once for every 1000 cum	CPWD/IS 2386/IS 456/IS 383 & Tech. Spec.	SR/TR	√	
v		**All other tests as required in Technical Spec. need to be tested before use.**								
G	**Rock Material for Rip Rap, Rock Toe and Random Rubble Masonry**									
i		Specific gravity	as required	B	Physical	Once for each source	IS:1122 and Technical Specification	SR/TR	√	
ii		soundness	Chemicals, oven balance etc.	B	Physical	Once for each source	IS:1126and Technical Specification	SR/TR	√	
iii		Impact Value	Impact Value testing apparatus	B	Physical	Once for each source	IS:2386 and Technical Specification	SR/TR	√	
iv		Water absorption	Balance, oven	B	Physical	Once for each source	IS:2386 and Technical Specification	SR/TR	√	
v		slake Durability	as required	B	Physical	Once for each source	IS:10050 and Technical Specification	SR/TR	√	
vi		placement profile thickness	as required	B	Physical	Random in each shift	IS:8237 and Technical Specification	SR/TR	√	
25	**HDPE LINING**									
i	Material		As agreed / required	A	Review of MTC / Test reports/ CHP	Each lot received at site	Tech Specs and/ Const. Drawings	MTC/TR/CHP	√	Co-relation of material with CHP or Roll no. or any other means may be verified with the lot received at site.
ii	Material Thickness		As agreed / required	A	Physical	Each Roll	Tech Specs and Const. Drawings	SR	√	Lowest individual of 10 values shall not be less than Nominal -10%.

iii	Installation & Laying of HDPE Lining System		As agreed / required	B	Physical	100%	Technical Specification, const. Drawings and Installation procedure	SR	√	HDPE manufacture shall submit the HDPE Liner Installation procedure to EIC.
iv	NDT Test for HDPE Liner (Air Pressure testing or vacuum Box testing)		As agreed / required	A	Physical	All field seams	Technical Specification, const. Drawings and Manufacturer Recommendation	SR/TR	√	
v	Destructive Seam Testing for HDPE Liner		As agreed / required	A	Physical	One test for every 150m length of seam or as directed by EIC as per TS.	Technical Specification, const. Drawings and Manufacturer Recommendation	SR/TR	√	
26	**GEOTEXTILE**									
i	Material		As agreed / required	A	Review of MTC/ test	Each lot of delivery	Tech Specs and/ Const. Drawings	MTC/TR	√	
ii	Identification of Material		As agreed / required	B	Visual	Each lot of delivery	Technical Specification, const. Drawings and Manufacturer Recommendation	SR		All rolls of the geo-textile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number and roll dimensions.
iii	Acceptance of Installation		As agreed / required	A	Physical	Random	Technical Specification, const. Drawings and Manufacturer Recommendation	SR	√	
27	**INSTRUMENTATION**									
i		Instruments (piezometer, Water Level Sounder, surface settlement etc. as required in TS)	As agreed / required	A	Review of MTC	Each delivery at site	Tech Spec and drawings	TR/MTC	√	
ii		Installation of the instruments at required location	As agreed / required	B	Physical	100%	Tech Spec and drawings/ IS 7356 Part I	SR		
iii		check for functioning of instruments after installation.	As agreed / required	A	Physical	100%	Tech Spec and drawings	SR	√	The instruments shall be accepted by the Engineer only after all the instruments have been demonstrated to be in working condition and initial set of measurement of piezometer shall be taken.

	LEGENDS : * **Records identified with tick (√) shall be essentially included by supplier in QA documentation.** **# Class A : Critical, Class B : Major, Class C : Minor.** **Class 'A' checks shall be witnessed by NTPC and Main contractor. Owner may associate, Class 'B' checks shall be witnessed by Owner, Execution Engineer and main contractor, Surveillance by NTPC/ Owner (FQA) Class 'C' checks shall be witnessed by Main contractor engineer. Surveillance by NTPC/ Owner (FQA** **SR - Site Register, TR- Test Report, LB-Log Book, IR - Inspection Report, MTC - Manufacturer's Test Certificate.** **Note: Any non confirmity/ deviation to the Quality plan must be brought to notice of NTPC/Owner.** **Dispositioning authority shall be the authorised representative of NTPC/Owner as per NTPC FQA system manual**	For Owner Use	Owner DOC NO. :		
Main-supplier			REVIEWED BY	APPROVED BY	APPROVAL SEAL

SUB-SECTION– E-60
Disclaimer for Indicative Vendors List

Disclaimer for Indicative Vendor List

1.1 Reasonable efforts have been made to collate the sub-vendors proposed by the various main contractors from time to time against different Projects/Packages and accepted by NTPC for various items. However, in case of error/omission, if any, and represented by the successful bidder this will be addressed during the execution of the contract based on the material evidence available with NTPC / Main Contractor.

1.2 The approved sub-vendor list drawn is not based on NTPC driven enlistment process but based on the sub- vendors proposed by various Main Contractors. As such, it is possible that some of the Suppliers/Manufacturers who may be involved in similar work/process may not be appearing in the list as such sub-vendors may not have been proposed by Main Contractors against NTPC Contracts.

1.3 In case the successful bidder chooses to propose additional sub-vendors with relevant experience after the award of the contract such sub-vendors will be considered in terms of Clause no: 19.1 of GCC, provided the proposals are received sufficiently in time: 90 days prior to ordering date of a Bought Out Items/Start of Manufacturing so as not to impede the progress of the contract.

1.4 Sub-vendors have been grouped under different categories of items. It is possible that an item characterized by certain specific features such as range and type required as per Main Contractor’s design requirements may not be in the range of the listed sub-vendor’s manufacturing process/capability. As such the main contractor to ascertain the vendor’s capability to meet his specific requirements before considering a sub-vendor.

1.5 It is to be noted by the bidders that any shortfall in contract performance attributable to the sub-vendor listed will not absolve the contractor from his contractual obligations in any manner.

1.6 The approval was granted based on the evaluation of relevant capabilities and facilities possessed by the sub-vendor at the time of evaluation. Also, some of the sub-vendors may not be active. As such, the successful bidder is to carry out his own due diligence before considering the listed sub-vendor for subletting: the current status of the sub-vendor, the continued availability of productive resources including Human Resources.

1.7 The list of sub-vendors is periodically revised to include new sub-vendors. Such a revision may also see a deletion of certain sub-vendors who may have been disqualified on grounds of inadequate performance or banned in line with NTPC's banning policy. The then current list will be shared with the successful bidder immediately on award.

1.8 In the post award during detailed engineering, Main contractor to take up with sub vendors and ensure/verify approval conditions of NTPC/Owner before placing the orders.