

GOVERNMENT OF HIMACHAL PRADESH



HANDBOOK ON QUALITY CONTROL

Part- C

Himachal Pradesh State Electricity Board Limited

Prepared by:



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PREFACE

The Government of H.P. felt its necessity that IQCS may be constituted to have an independent quality check and positioned in CM office. The squad shall be headed by the Team Leader and ably assisted by specialist/expert having vast experience in Civil Engineering works, Mechanical, Electrical works and IPH works being executed by the various departments.

WAPCOS Ltd., A Govt. of India Undertaking, Ministry of Jal Shakti, Chandigarh office has been entrusted with the task of implementing this program for total quality management concept aimed at embedding awareness of quality in all infrastructure departments of Govt. of H.P. including but not limited to PWD, IPH, HPSEB, Urban development, Forest, Tourism, RDD and HPSIDC etc.

In this respect this handbook has been prepared which is brief, handy and instant helpful at site for field engineers. It is an effort just like to express too much in too few words. It summarizes all quality assurance, specifications and prepared on basic sources viz HPPWD specifications for building and roads, rural road manual, MORTH and handbook of quality control Vol.- 1 and Vol- 2. The IPH contents have been taken from CPEHEEO, AWWA manual, Pollution Control Board and Relevant Standard codes etc. The handbook has been prepared by in cooperating relevant extract from HPPWD specification keeping in view subsidiary departments also and prevalent practice being followed at present.

In preparing this handbook the sincere efforts have been made by the team of WAPCOS Ltd. along with the officers of Himachal Pradesh State Electricity Board Limited, Himachal Pradesh.

We dedicate this effort to the state and hope this handbook shall be very useful for all the field engineers for various departments of Govt. of HP and advised that it may always be kept with them at site as ready and instant reference. We are further hopeful that the state authorities would evolve suitable mechanism to implement the needed quality assurance plan with objective of achieving the economic and social development of the State and improving the quality of life of people.

**WAPCOS Limited
A Govt. of India Undertaking
Ministry of Jal Shakti
Chandigarh Office**

CONTENTS

HANDBOOK ON QUALITY CONTROL

PART- C **(HIMACHAL PRADESH STATE ELECTRICITY BOARD LIMITED)**

Chapter No.	Subject	Page No.
Chapter- 1	Installation of poles, conductors, transformers for power distribution	1-10
Chapter- 2	Safety Precautions & Instructions	11-21
Chapter- 3	Safety Rules For Authorized Line Staff	22-30
Chapter- 4	Safety Devices and Equipments	31-36
Chapter- 5	Earthing	37-42
Chapter- 6	Construction and Transportation	43-47
Chapter- 7	Tools & Plant	48
Chapter- 8	First- Aid	49-55
Chapter- 9	Safety bindings on Contractors	56-62
Chapter- 10	Do's and Do Not's	63-64
Chapter- 11	Safety and Disaster Management	65-70
Chapter- 12	Construction Underneath Overhead Lines	71-75
Chapter- 13	Capacitor KVAR at different Motor ratings and speeds	76-81
Chapter- 14	Field Quality Plan Transmission line	82-130
Chapter- 15	Field quality plan Sub Station	131-246
Chapter- 16	Field Quality Plan/ Guidelines for construction of Over Head HT/ LT Lines	247-251
	Field Quality Plan for Conductor, Earthwire & AB Cable Erection	252-327

Chapter-1

INSTALLATION OF POLES, CONDUCTORS, TRANSFORMERS FOR POWER DISTRIBUTION

1.1 General: Before going to discussion on poles, conductors, transformers, generators and all other allied equipments, electrical materials, classification of voltage is given as under:

1. Low voltage – not exceeding 250 volts
2. Medium voltage – not exceeding 650 Volts
3. High voltage – more than 650 Volts and up to 33kv
4. Extra high voltage – more than 33kv

1.2 Electric Pole: A pole or utility pole or post used to support overhead power lines and various other public utilities such as cable, fiber optic cable and related equipment such as transformers and street lights. Supports for overhead lines are mainly two types (a) Pole and (b) Tower. Up to 33kv in distribution system, poles are used and above 33 kv, towers are used. Different types of poles:

1. Wooden pole
2. PCC pole
3. RCC pole
4. Rail pole
5. Steel pole
6. Steel towers
7. Presently, steel tubular poles are being preferred for use on LT & HT lines e.g.
 - I. LT poles (240 V to 440 V) → 8 to 10m long- depending upon site for erection w.r.t. ground clearance.
 - II. HT poles (11 kV to 33 kV) → 9 to 13 m long – depending upon site for erection w.r.t. ground clearance.
 - III. Rail poles & Girders → 11 to 13m are also used on 33 KV lines and substations.
 - IV. For 66 kV & above voltage level, Steel Towers are used for 66 KV, 132 KV, 220 KV, 400 KV Transmission Lines and Steel Columns and Gantries are used for 66 kV, 132kV, 220kV, 400kV Substations.
 - V. Steel tubular poles shall confirm to IS: 2713 (Part I & III): 1980.

1.3 Conductors: Any substance which allows the electric current to flow through it is called conductor. e.g. silver, copper, aluminum, iron, steel etc. silver is the best conductor but is very costly (about Rs 40,000 to 45,000/kg now a days), copper is the 2nd best conductor but also comparatively costly about Rs 450 to 500/kg. Ultimately, aluminum is the optimal conductor because of its low resistance, light weight, cheapest in cost (Rs 130 to 150/kg now a days in the market) and good electrical properties.

- To obtain higher tensile strength in aluminum conductor, it is steel reinforced (or used together with strands of steel) so called ACSR conductor.
- ACSR conductors which are generally used in our distribution & transmission lines are called by name of animals:
 1. Weasel conductor – ACSR 6/1/2.59mm – used on 230 V or 400 V lines.
 2. Rabbit conductor - ACSR 6/1/3.35mm – used on 11kV lines.
 3. Dog conductor - ACSR 6/1/4.72mm – used on 33kV lines.
 4. Wolf conductor – ACSR 30/7/2.59mm – used on 66kV lines.
 5. Panther conductor – ACSR 30/7/3.00mm – used on 132kV lines.
 6. Zebra conductor – ACSR 54/7/3.18mm – used on 220 kv lines.
 7. Mouse conductor – ACSR 54/7/3.53mm – used on 132 kV or 220 kV bus bars.
- Likewise AAC (All Aluminum Conductor) or AAAC (All Alloy Aluminum Conductor) are used in low, medium and high voltage lines with usually shorter spans (extensively in urban areas). Types of AAC are given as under:
 1. Gnat – AAC 7/2.21mm
 2. Ant – AAC 7/3.10mm
 3. Wasp – AAC 7/4.39mm

Though AAC or AAAC has very good conductivity but has very low mechanical or tensile strength.

1.4 Transformers: A transformer is an alternating current static machine used to step up or step down the voltage to its desired level for transmission or distribution purpose keeping the electrical power same. The transformers are rated in kVA. Transformer may be single phase or 3 phases.

- Thus a distribution transformer is used to step down high voltage (so called HT or HV) from 33kV, 22kV or 11kV to required distribution voltage level of 400V (line voltage - for industrial consumer's use) or 230 volts (Phase voltage – for domestic consumer's use) e.g. 33/0.4kv, 22/0.4kv or 11/0.4kv. The general ratings of distribution transformers may be 25 kVA, 63kVA, 100kVA, 250kVA, 400kVA, 500kVA, 630kVA, 1000kVA or 1 MVA etc.
- Low rating transformers 25, 63, 100, 250 kVA may be pole mounted while higher rating capacity transformers having more weight are stationed on ground followed by barbed wire/mesh fencing.
- Generally, 33/0.4 kV transformers is used as station transformer or as per voltages existing at Sub-Station.

1.5 Wiring: Electrical wiring is an electrical installation of cabling and associated devices such as switches, distribution boards, sockets and light fittings in a structure.

- These are different types of wiring:
 1. Cleat wiring
 2. Wooden casing & capping wiring
 3. CTS or TRS or PVC sheathed wiring
 4. Lead sheathed or metal sheathed wiring
 5. Conduit wiring

The most commonly used material for electrical wires and cables is copper because copper has low resistance and twice the tensile strength of aluminum.

Electrical wiring, in the light of quality assurance, should have features such as fire retardant, low smoke, 100% copper bunching, anti-rodent, corrosion resistance, good insulation material.

- The international standard wire sizes are given in IEC-60228. In India, we use ISI marked materials.
- In a typical electrical code, some color-coding of wires is mandatory. In India, phase colors adopted for wires are red color for R-phase, yellow color for Y-phase, blue for B-phase, black color for neutral and green color for earth.
- The prescribed tests for quality assurance of wiring in an electrical installation are given as under:
 1. Wiring continuity test or continuity test of wiring.
 2. Insulation resistance test – should not be less than 50MOhm.
 3. Earth continuity test – resistance should not be more than 1 ohm.
 4. Earth resistivity test (earth resistance test).
 5. Performance test and any other tests as instructed by the Supervising Engineer in conformity with IEE regulations.

ISI standards for electrical wiring are:

- IS: 732-1989 Code of practice for electrical wiring installation.
- IS: 4648-1968 Guide for electrical layout in residential buildings.
- IS: 8884-1978 Code practice for installation of electric bells and call system.
- IS: 2672-1966 Code of practice for library lighting.

1.6 Conduits: An electrical conduit is a tube used to protect and route electrical wiring in a building or structure. Mostly conduits are rigid but flexible conduits are also used for some purposes.

- These are different types of conduits used commonly in residential and commercial wiring:
 1. Rigid Metal Conduit – RMC and IMC
 2. Electrical Metallic Tubing – EMT
 3. Electrical Non-metallic Tubing – ENT
 4. Flexible Metal Conduit – FMC
 5. Rigid PVC Conduit

Conduits are subjected to following tests:

- Bending Test
- Compression Test
- Collapse Test
- Impact Test

PVC conduits (DIPLAST, POLYFIT-make) and steel conduits [ISI marked (9537), Part-II, 1981 standards] are available in sizes of 20mm, 32mm, 40mm, 50mm, 63mm. These conduit pipes are available in standard length of 3 meters.

1.7 Switches: Electric switch is a device which is used for making and breaking of an electric circuit (e.g. To make ON or OFF light, other house hold appliances like induction heaters, water heaters /Geysers, electric iron, washing machine, juicer and mixer grinder, refrigerators etc.)

Testing of switches is done:

1. Tests with an ohmmeter (multimeter)
2. Tests with a test lamp
3. Pen tester

The material used for switches (i.e. Metal contacts and moulded body) should confirm to IS 3854(1997) standards with reference to quality assurance.

1.8 Preventive Maintenance Schedule for Maintenance of Important Equipments

- The proper maintenance of a electrical system not only improve the reliability but also generate revenue to the electrical utilities.
- The old concept of breakdown maintenance can be deferred by adopting periodical testing [monthly (M), quarterly (Q), half yearly (1/2Y), yearly (Y), 2 years (2Y), 3 years (3Y), SOS (as and when required) etc.] of equipments and its accessories and thus doing preventive maintenance (repair or replacement, if any) accordingly.
- The preventive maintenance is much relevant to keep the equipment continuously in service for desired output over a long period span. The preventive maintenance schedule for maintenance of important equipments installed at an electrical sub-station is to be followed as per CBIP manual as under:

Transformers:

- Without shut down activities:

Checking of bushing oil level, oil level in conservator, oil level in OLTC conservator, oil level in oil seal of breather → Monthly

Checking of silica gel in breather → Monthly

Manual actuation of cooler oil pumps and fans → Monthly

With shut down activities:

- BDV, PPM of transformer oil → Yearly
- External cleaning of radiators, marshalling boxes of transformers → Yearly
- Cleaning of all bushings → Yearly
- Checking of auto starting of cooler pumps and fans → Yearly
- Checking of Buchholzrelay by oil draining → Yearly
- Tan δ measurement for bushings → Yearly
- Checking of earthing connections → Yearly
- IR measurement of winding → Two Yearly
- Tan δ measurement of windings → Two Yearly
- Checking & cleaning of diverter contacts → Two Yearly
- Checking and calibration of OTI (Oil Temperature Indicator), WTI (Winding Temperature Indicator) → Two Yearly
- Measurement of winding resistance at all top positions → Four Yearly

Circuit Breaker:

- Checking of all interlocks, pressure settings, all operation lock outs → Yearly
- Cleaning of breaker interrupter, support insulators, PIR and grading capacitors → Yearly
- Checking of pole discrepancy relay, pressure settings → Yearly
- Function checks, duty cycle operation including rapid re-closing → Yearly
- Checking of CB operating timings → Yearly

SF₆ Circuit Breakers: Now a, being used on 66kV, 132kV, 220kV, 400 kV and above voltage level sub-stations.

- Checking of oil leaks from grading capacitors → Monthly
- SF₆ gas leakage test → SOS
- Dew point of SF₆ gas → 3 Yearly
- Checking tightness of foundation bolts → Yearly
- Vacuum Circuit Breaker (VCB): (Now days, being used on 11kV, 22kV & 33 kV sub-stations.)
- Checking of vacuum interrupter → Yearly
- Replacement of vacuum interrupter → SOS
- Cleaning of control cubicle and checking for loose connection → Quarterly
- Checking of ON/OFF indicator, spring charge indicator and checking of manual and electrical operation → Half Yearly
- Checking of foundation bolts → Yearly

Current Transformers (CT's)

- Visual inspection of CT for oil leakage and cracks in insulator etc. → Monthly
- Checking of bellow expansion → Monthly
- Thermo vision scanning of CT → Yearly

- Checking of oil leakage in terminal box → Yearly
- Checking of primary connections strips (if provided externally) → Yearly
- Measurement of Tan δ and capacitance → 2Yearly

**Potential transformers (PT's)/ Capacitance Voltage Transformer (CVT)/Coupling Capacitor/
Voltage Transformer (VT)**

- Checking of oil leaks → Monthly
- Measurements of voltage at control room panel → Half Yearly
- Visual checking of earthing HF point (if it is not being used PLCC) → Yearly
- Cleaning of CVT capacitor stacks and tightness of terminal connections →- Yearly
- Thermo vision scanning of capacitor stacks → Yearly
- Capacitance and Tan δ measurement → 3Yearly
- Testing of oil for BDV (if oil found discolored) → SOS
- Checking for rust and painting → SOS

Disconnectors (i.e. isolators) and Earth Switches:

- Cleaning and lubrication of main contacts, pins and bearings → Yearly
- Checking of interlocks, earth connections of structure, tightness of bolts, nuts & pins, healthiness of gaskets etc → Yearly
- Check operation of isolators and earth switches → Yearly
- Check contact resistance measurement → 2 Yearly
- Check alignment of isolator blades/earth switch blades → 2 Yearly

Surge Arrestors/Lightning Arrestors

- Checking of leakage current → Yearly
- Testing of surge counters and leakage current meters → Yearly
- Cleaning of insulators → Yearly
- Checking of earth connections between surge arrestor, surge monitor and earth → Yearly
- Measurement of capacitance and Tan δ and IR of each stack → SOS

Bus-bar, Jumpers, Connectors, Clamps, Switchyard illumination etc.

- Visual inspection of insulators for cracks, cleaning of insulators → Yearly
- Removal of hot spots, De-weeding of switchyard → SOS
- Repainting, rust removal of all structures, equipments etc. → SOS
- Thermo vision scanning of all conductor joints, terminal connectors/clamps → Yearly
- Measurement of earth resistance, checking of earthing connection of all structures → Yearly

Wave traps

- Tightness and cleanliness, general inspection/cleaning of tuning unit cleaning of post insulators (if provided) → Yearly
- Thermo vision scanning of joints → Yearly
- Repair of bird guard → Yearly

Batteries and DC distribution system

- Checking of electrolyte level and topping up with distilled mineral water (if required), measurement of specific gravity and voltage of each cell → Monthly
- Checking of emergency DC lightning to control room and checking of any earth fault (if E/F relay not provided) → Monthly
- Checking of electrical connections for batteries and application of petroleum jelly on each cell terminal if required → Yearly
- Checking of electrical connections for charge panel and DC DB panels for tightness and cleanliness → Yearly
- Checking control cards of charger and measurement of test point voltage values → Yearly

LT Switch Gear, LT Transformer, LT Panel etc. LT Switchgear

- Cleaning of insulators and tightness of terminal connections of CBs, CTs, PTs, isolators etc. → Yearly
- Alignment checking of isolators → Yearly
- Functional checking (trip, close etc) of 33/11 kV CBs → Yearly
- Measurement of operating timings → 3Yearly

LT Transformers

- Testing of oil BDV, testing/checking of OTI, WTI & Buchholz (if provided) → Yearly
- IR measurement → Yearly
- Checking healthiness of Buchholz relay, pressure relief diaphragm → Yearly
- Checking tightness of earthing connections → Yearly

LT Panels

- Cleaning of panels, bus bars insulators etc. → Yearly
- Relay testing → Yearly
- Tightness of all electrical connections → Yearly
- Checking of indicating meters, spring charging of CB, operation indications in off-load condition of CB → Yearly
- Checking for change over facility, if provided → Yearly
- In addition to above, a similar deep thought needs to be given towards preventive maintenance of switchyard, lightning system, fire-fighting system, cooling system/exhaust system, PLCC system/ Telephone exchange, Air-Conditioning Plant/system, all motors & pumps installed as accessories of equipments, DG set (i.e what-so-ever installed at the sub-station) for relevant equipments healthiness, efficiency and longer life.

1.9 Recommended list of Vendors

- Different vendors manufacture and sell different class (i.e. EHV class or HV class) electrical equipments/electrical item according to their suitability and specialization in the field.
- Some vendors manufacture inventorial items and sell these items to consumers (through their marketing division) while some vendors may offer services or experience.

S. No.	Item Description	Preferred make
1.	Transformers: 220kv, 132kv, 33kv, 11kv, 6.6kv	BHEL, CGL, EMCO, AREVA, ABB, TELK, SIEMENS
2.	Circuit Breakers (CB): 220 KV, 132KV CKT BREAKERS 33kv, 22kv, 11kv, 6.6kv vacuum ckt breakers	ABB, CGL, SIEMENS, AREVA ABB, CGL, SIEMENS, AREVA, BHEL, Schneider, Jyoti (Jyoti up to 11kv only)
3.	Current Transformer (CT): 220 kv& 132kv CT 33Kv, 22Kv, 11Kv, 6.6KvCT	ABB, TELK, BHEL, CGL, AREVA ABB, Pragati, Intra Vidyut, Prayog, Insutech Industries
4.	Potential Transformers (PT): 220 kv, 132kv PT 33kv, 22kv, 11kv,6.6kv PT	ABB, TELK, BHEL, CGL, AREVA ABB, Pragati, Prayog, IntraVidyut, Jyoti
5.	Capacitance Voltage Transformer 220kv and 132kv CVT	AREVA, ABB, CGL, BHEL
6.	Lightening Arrestors (LA) 220kv and 132kv (LA) 33kv, 11kv, 6.6kv (LA)	OBLUM, Elpro, AREVA, CGL OBLUM, ELPRO, SIEMENS, TOSHIBA, WS-Insulators
7.	Isolators 220kv and 132 kv Isolators 33 kv, 11kv, 6.6kv Isolators 11kv Go Switch	S&S Pondicherry, Elpro, ABB, AREVA, CGL, WS-Insulator. ABB, SIEMENS, CGL Pactil & Panchkati, Kayal & Co.
8.	Condenser Bushings 220kv& 132kv	BHEL, CGL, AREVA, TELK
9.	Capacitors 33kv, 11kv, 6.6kv	ABB, Unistar (Universal Cables), BHEL, Meher (Bangalore)
10.	Cable joining kits 33kv, 22kv, 11kv, 6.6kv	Raychem, CCI, 3M, M-Seal (M-seal for 6.6kv)
11.	Battery Charger	Chhabi Electricals, Standard, Hi-rect, Amara Raja
12.	Lead Acid Battery	Exide, AMCO, Amara Raja

13.	Electronic Energy Meters (Trivector/KW)	SEMS, L&T, SATEC, ABB, SIEMENS, AREVA, Schneider, Dukati, CONZERVE
14.	Annunciators	Minilec, SPA, Procon, Yashmun
15.	EHT/HT Insulators i) Porcelain ii) Epoxy insulator	WS-Insulators, Jayashree, BHEL, A-bond strand, S&S, AREVA, OBLUM. A-Bond Strand, Power Com Electrical Pvt. Ltd., Baroda Bushings, S&C Electric Co. (America), RISHO-KOGYO Co. Ltd (Japan)
16.	Protection & Auxiliary Relays	ABB, SIEMENS, L&T, AREVA, Schneider
17.	Recorders (Chartless Type)	Chino, Yokogawa India Ltd., Fuji, Okhura, ABB, Tata Honeywell, Hioki
18.	HT HRC Fuses	S&S, GE Power Control, Bushmann, SIEMENS, ABB, Drescher Paniker
19.	HV/LV Bus Duct	Best & Crompton, ECC (KolKatta), Star Drive (Chennai), Empro (Chennai), Advance Power Control Advance Power Control for LV Bus Duct Only

A. (i) List of approved makes of Electrical Accessories for E.I. Works

S. No.	DESCRIPTION OF ITEMS	BRAND / MAKE
1.	Piano type switch sockets, ceiling rose and bakelite lamp holders.	ANCHOR, ESS ESS KAY POWER, KINJAL
2.	HRFR & LS Copper conductor PVC insulated wires.	HAVELL'S, L&T, PLAZA FINOLEX, ANCHOR CAP-CAB
3.	Steel conduits	ISI MARKED (9537) Part-II, 1981.
4.	PVC conduits	DIPLAST, POLYFIT
5.	Modular switch sockets	ABB, HAVELL'S, LEGRAND SSK, NORTH – WEST L&T
6.	Change-Over-switch	SCHNEIDER, L&T, ABB C & S
7.	Bus Trunking	SCHNEIDER, LEGRAND C&S, SIEMENS, G.E.,

A. (ii) CATEGORIZATION OF ELECTRICAL ITEMS

S. NO.	DESCRIPTION OF ITEMS	CATEGORY			
		CAT – A+	CAT-A	CAT-B	CAT-C
1.	Switch disconnecter fuse unit with ISI marked HRC/HBC fuse in sheet steel		L&T ABB SCHNEIDER	G.E. HAVELL'S CROMPTON	STANDARD SUPERTECH AECO GECO
2.	Switch disconnecter fuse units with ISI marked HRC/HBC fuse in Open execution		L&T ABB SCHNEIDER	G.E. HAVELL'S	STANDARD SUPERTECH
3.	Miniature circuit breakers 240/415 volts	ABB LEGRAND HAGER	HAVELL'S L&T G.E. C&S	STANDARD ANCHOR	GECO SIGMA
4.	Residual current circuit breakers (RCCB)	ABB LEGRAND HAGER	HAVELL'S L&T G.E. C&S	STANDARD	
5.	Water heaters (Geysers)			RECOLD BAJAJ CROMPTON GREAVES SPHEREHOT VENUS	PEARL
6.	Ceiling fans / Exhaust fans Note: The Model for specified brands to be approved by the Engineer-in-Charge			USHA BAJAJ CROMPTON HAVELL'S KHAITAN	
7.	Indoor lighting		TRILUX (through Bajaj) KESELEC SCHREDER PHILIPS	BAJAJ HAVELL'S G.E. DECON CROMPTON	
8.	Outdoor lighting		TRILUX (through Bajaj) SCHREDER PHILIPS	G.E. BAJAJ HAVELL'S	

Chapter-2

SAFETY PRECAUTIONS & INSTRUCTIONS

2.1 General Safety Precautions:

Safety Precautions are necessary to avoid the accidents and the General Safety Instructions that are required to be followed are as follows:

1. All voltages shall be considered dangerous even though it may not be high enough to produce serious shock.
2. All Electric circuits are to be treated as live and no work (maintenance, repairs, cleaning) is to be carried out on any part of electrical apparatus on circuit unless such parts are:
 - a. Dead.
 - b. Isolated and all practicable steps taken to lock off from live conductors.
 - c. Efficiently connected to earth between such points and points of work.
 - d. Permit to Work (PTW), to work on the equipments has been issued.
 - e. By ensuring the equipment and conductor for its de-energized condition.
3. Working Conditions requiring more than one work man
 - I. On some hazardous works it is not desirable for one man to work alone. The AE/JE shall determine when additional men are needed to protect authorized line staff against accidents or to render assistance in case of unforeseen circumstances.
 - II. On especially hazardous jobs where close clearance or difficult working conditions are encountered, an observer may be required. On any job which in the opinion of the AE/JE requires an observer, the AE/JE or a man appointed by him will act as an observer. The observer should not engage in any activity that will interfere with the duty.
4. Under no circumstance shall an authorized line staff hurry or take unnecessary chances when working under hazardous conditions, neither shall he attempt to perform hazardous work when extremely tired or exhausted.
5. Authorized line staff must use the standard protective safety equipment intended for each job.
6. Only experienced/authorized line staff shall be permitted to clean around energized or moving equipment.
7. The authorized line staff working on pole or in all elevated position should not work on electrical apparatus or circuit without using a suitable safety belt or other adequate means to safe guard against falling.
8. Circuits should be tagged, marked or lettered unless clear identification by other means exists.
9. No authorized line staff should go or take any conduction objects within the distance given from any exposed live part at the voltages specified.
10. Telephone conductors and ground wires of lightning arresters, though they may be at or near ground potential are liable to develop high-induced voltage under fault conditions. Suitable precautions should be taken' when working on or near such circuits.

11. When fighting fires near exposed live parts, authorized line staff should avoid using fire-extinguishing liquids, which are not insulating. If necessary, all neighboring equipment may be disconnected or made dead.
12. After tripping of circuit breaker the isolation in air media by an air break switch or isolator should preferably be visible.
13. No signal system like waving hands, flags and whistle should be resorted to communicate or convey instructions.
14. Adequate insulation should be provided where any part of the body is likely to come in contact with live lines or equipment. .
15. Parts of equipment or apparatus, which may develop dangerous potential due to surges, arcs or insulation failure, may be grounded for safe working conditions.
16. Do not use bare fingers or hands to determine whether a circuit is live.
17. Do not depend upon insulation of cables for safe working.
18. In handling portable apparatus or lamps, first make sure that the extended metal frame is not live by contact with or leakage from live parts within. Have such portable equipment inspected at least once daily during the period of their use. Do not attempt to make any alterations or adjustments in portable equipment without cutting off supply.

2.2 SAFETY PRECAUTION FOR WORK ON OVERHEAD MAINS, SERVICE LINES.

Working on Dead line and Equipment: No authorized line staff shall work on line supports or conductors unless these are discharged and earthed as follows:

1. The circuit or conductor to be worked on shall be made dead by switching off or opening the isolator links or fuses and by locking isolator/links in the off position. A danger notice board with the words "DO NOT CLOSE", 'MEN ON LINE' should be fixed securely, below the switch or links/isolator. The operational sequence for maintenance of electrical system must be as under:

Before maintenance the operational sequence must be:

PTW → CB [Off] → ISOLATOR [Off] → ISOLATOR with earth blade

After maintenance the operational sequence must be:

ISOLATOR with earth blade [remove earth blade] → ISOLATOR [ON] → PTW (Cancellation) → CB [ON]

2. After switching off the supply, before touching the lines, each conductor of line shall be tested for pressure (*voltage*) by a discharge rod. The discharge wires should be kept at least two feet away from the body. The procedure is necessary in order to make sure that the line to be worked on is actually the line that has been isolated. Rubber gloves or preferably gauntlets should be used on both hands.
3. All the conductors shall then be short circuited together and adequately earthed: this shall be done at the points on each side of the place thereby creating a safety zone where the work is carried out. Rubber gloves or gauntlets shall be used while doing this work. Poles on which work is actually to be carried out should also be earthed.

4. A working section at either end of which the conductors are earthed shall not exceed 1.5 km in length. In the case of lines meeting or crossing at any pole which forms the site of work, all the lines crossing or ending at that pole shall be earthed as stated above unless work on the one line with any or all the remaining lines alive is otherwise permissible and so specified in the permit-to-work.
5. Ensure that there is no possibility of back feed due to some emergency electrical supply such as DG sets, invertors, solar panels or other energy source installed in the system.
6. All phases shall be earthed even if work is to be carried out on one phase only.
7. When work is to be carried out on lines of all insulated conductors where grounding points are not provided at point of work, temporary grounds shall be connected at point of work to an efficient portable earth straight driven into the ground. The line shall also be grounded at the nearest line grounding point on either side of the point of work.
8. Where two or more crew of authorized line staff are working independently on the same line or equipment, each crew shall properly protect them by placing their own temporary grounds.

2.3 Working on lines and equipment adjacent to live equipment or lines

1. When working near live lines or apparatus, each man should plan his moves and take extreme care in moving from one position to another.
2. Where impractical to erect barriers between men at work and live parts within reach of their hands and objects being handled, continuous watch shall be kept by the Foreman or someone specifically designated by JE/AE in charge for that purpose.
3. When a truck is used near live parts, all workmen except the driver should stay away from the truck. Driver should see that truck is clear from live lines before leaving and entering the truck. To maintain Equip-potential, the authorized staff near the vehicle must have insulated rubber mats underneath.
4. Special care should be taken while working on T-off/4-pole or 6-pole structures under direct supervision of foreman by providing suitable lock and key arrangement.

2.4 Work on Double Circuit Overhead lines with one Circuit alive

1. To distinguish dead circuit from a live one, green flags should be fit on the tower/poles. Flags of any other color shall not be used for indicating a dead circuit.
2. Flags will be removed only after work is finished and temporary ground has been removed.
3. If the Sub-Station has source supply from one of the circuits and shut down of sub-station is required, it should be ensured that no work on CVT, Wave trap, coupling capacitor should be carried out. For maintenance/replacement of CVT, Wave trap, coupling capacitor PT and LA's both circuits are to be de-energized after standard shutdown procedures.

2.5 INSPECTION OF EQUIPMENT ON LIVE LINES:

1. Inspection will be carried out from ground level.
2. No man shall climb above the anti-climbing device until under observation by another at ground level.

2.6 TESTING OF INSULATORS ON LIVE LINES:

1. Special care will be taken at tension, double circuit, transposition and terminal tower, poles in view of close proximity of live crossover connections.
2. Works shall be carried out under "Caution Order" as in the case of Hot Line work.
3. Testing shall not be carried out when humidity is above normal and shall be discontinued if thunderstorm approaches.
4. One man should be stationed on ground to see that the man testing the insulator maintains necessary clearances.

2.7 Work on Poles and Towers

1. Before climbing an elevated structure every, authorized line staff shall first assure himself that the structure is strong enough to sustain his weight safely.
2. If poles or cross arms are apparently unsafe because of decay or unbalanced tensions of wires on them, they shall be properly braced or guyed before they are climbed.
3. In choosing the climbing side, the side at the pole where the ground wire is attached should not be used.
4. The workman should avoid using conductors, insulators, pins and so forth as hand holds and should not rest on street light fixtures or other apparatus on the poles or structures.
5. Authorized line staff shall wear their safety belts while working on the poles and towers.
6. Wire hooks shall not be attached to authorized line staff belts or safety straps.
7. Safety straps should be placed above the top cross arm when it is at the top at the pole.
8. When two or more men are ascending a pole the second man should not start climbing until the first man is in a safe position or when descending until the first man is on the ground.
9. Before climbing a pole for carrying out any work, the condition of adjacent poles should be checked and, if required, they should be guyed or reinforced. The adjacent poles should also be checked for loose or broken tie wires, broken insulators, etc.
10. On arriving at the working position, the authorized line staff should put his safety belt around the pole or some other suitable supports and make sure that the belt is properly secured. Care should be taken to prevent the straps on safety belt coming in contact with anything that may open the snap and thus release the safety belt. Safety belts should not be attached to insulator pins, span wires, guy wires etc.
11. Authorized line staff tools should be so secured that they will not fall out of the tool belts. An authorized line staff should carry only the minimum number of tools in his belt. All other tools should be kept on the ground until they are required and then raised by means of a material bag attached to a hand line.
12. Ordinarily no authorized line staff should work vertically below another authorized line staff on the same pole except under emergencies. When this condition is necessary, extreme care should be taken to prevent tools or other objects being dropped upon the man below.

13. When transferring wires and equipment from an old pole to a new pole, the old pole should either be locked to the new pole or guyed or both, as the condition may demand.
14. Before an authorized line staff cuts an overhead conductor he should make sure that it will fall clear. Where there is a possibility of the falling line coming in contact with another wire or doing other damage, it should be lowered with a rope.
15. All light equipment and tools to be used aloft should be raised and lowered by means of a hand line and canvas bucket, or other suitable container. Men on the ground should stand clear of overhead work to prevent being struck by falling objects.
16. Tools and materials should not be thrown from the ground to an authorized line staff working aloft, nor should authorized line staff throw tools and materials from working place to the ground.
17. No authorized line staff shall work in such a manner that his arms or any tools extend beyond the body of tower when working on the live side.
18. Broken insulators or other sharp edged material shall not be left in vacant lots, along the right of way or in the location where the hazard of cutting feet could be caused for men or animals.
19. When stringing wires across streets and highways, avoid interfering with traffic or causing injury to workmen or pedestrians. Danger signs should be erected on both sides of the work location and where conditions warrant, flag-men should be stationed. No stringing should be done with the force of vehicle.
20. Hand lines, materials, tools or equipment must not be scattered around streets, sidewalks, highways, etc., but must be kept in a neat and orderly manner where they will not be liable to cause accident.
21. In handling wires on a pole, they should be raised or lowered with a dry hand line and extreme care should be exercised to prevent them from coming in contact with live lines and equipment.
22. A safety belt should be used when working on overhead locations. In its absence, manila rope may be permitted round the waist of the workman and tied to cross arm or pole as an alternative to the use of safety belt, under exceptional circumstances. The ropes should be kept in good condition and scrapped when not safe. It is necessary that the rope is twisted round the pole once or twice in order that release of tension on the pole may not cause it to slip down the pole.
23. Use ladders of suitable lengths to go up the poles to replace fuses or to carry out other minor works on feeders and wherever possible or necessary, dry hickory rod should also be used.

2.9 SAFETY PRECAUTIONS FOR WORK ON UNDERGROUND MAIN/CABLES

- **Work on Live Low Voltage Mains**

Only competent, experienced and authorized line staff may work on live low voltage mains and testing apparatus only after adhering to the entire requisite safety requirement.

- **Use of Insulating Guards**

1. No authorized line staff shall work on low voltage main with live conductors (UG Cable) alongside him until all those conductors are insulated for a distance at least 900 mm on each side of his body with tile insulating hose or mats provided for the purpose,
2. The neutral shall be regarded as a live conductor.

- **Work on Dead Low Voltage Mains:** Unless an authorized line staff is authorized to work on live low voltage mains and testing apparatus, all low voltage mains testing apparatus to be worked upon, shall be isolated from all sources of supply, proved dead, and measures shall be taken against the inadvertent energizing of the mains and apparatus.

- **Testing Low Voltage:** An authorized line staff shall not apply low voltage, for test purpose, to any mains, unless he has received a permit to work and warned all other authorized personnel working on the mains of the proposed application of low voltage for test. Where any part of the mains which will then become live is posed, the Supervisor in charge of the test shall arrange for an authorized line staff to stand by at the exposed part during the whole period of the tests.

- **Work on High Voltage Mains**

While working on High Voltage underground mains, the following shall be complied with:

1. The dead cable should first be identified by approved means.
2. Before working on underground cable, all its conductors shall be effectively discharged and earthed at both ends and the earthing switches wherever installed shall be locked up.
3. The neighboring cables, if any, should be adequately protected.

2.10 Minimum Working Distance

1. No authorized line staff shall work within the minimum working distance, which is normally, 4'/1.2 Mts. from the exposed live high voltage mains.
2. Under certain conditions, for special work and in an emergency, all authorized line staff may work within the minimum safe working distance where the work is directly and specifically sanctioned by the Foreman / JE responsible for the work and authorized line staff is fully experienced, and aware of the dangers that exist.
3. In all such cases, the authorized line staff shall be accompanied by another person that is also aware of the dangers which exist and who is capable of rendering First Aid and Artificial Respiration.

2.11 Devices for proving Dead High Voltage Mains

1. Only devices approved and issued for the purpose shall be used:
2. The High Voltage Neon Lamp contact indicator rod may be used for proving dead exposed high voltage mains. Each rod is fitted with an indicating Neon tube which should glow when the contact end of the rod is applied to exposed live high voltage mains. Each rod is clearly marked for the maximum voltage on which it may be safely used and must not, under any circumstances be used on higher voltages.

3. High Voltage contact phasing rods are provided for phasing and proving dead exposed high voltage mains. A set consists of two rods connected in series by a length of insulated cable. Both rods are fitted with contact tips and indicating tubes. When the contact tip of one rod is applied to exposed live high voltage mains and that of the other to earth or other exposed live high voltage mains and when there is a sufficient difference of potential from that to which the first rod applied, the indicating tubes should glow. Each set of rods is normally marked for the maximum voltage on which it may be used and must not, under any circumstances be used on higher voltages.

2.12 Use of High Voltage Contact Indicator and Phasing Rods: While using the high voltage contact indicator and phasing rods, the following shall be complied with:

1. Ensure that the rod is clean and dry.
2. Check the rod by applying it to known live mains of the correct voltage -the indicating tube must glow.
3. Apply the rod to each phase of the mains to be proved dead. The indicating tube must not glow. Be very careful to be in a position to see the glow in the indicating tube, if any, should appear.
4. Again, check the rod by applying it to live mains as in (2) above. Again, the indicating tube must glow.

Note: All the above operations shall be carried out at the same place and time. If no live high voltage mains or apparatus are available on the site, rods up to 11 kV may be tested by applying them to the top of ZI spark plug in running motor car engine. If the rod is in order, the indicating tube will glow each time the plug sparks. Therefore, the glow will be intermittent, but the indicating tube must glow on this test or the rod is useless as a means of proving dead. Remember to test the rod before and after use.

2.13 Work on Cubicle Type High Voltage Panels: If draw out cubicles are the ones on which work is programmed, these cubicles shall be drawn out after switching off circuit breakers, and the draw out panels effectively discharged before any work is done over the same.

2.14 General Safety Instructions

2.14.1 Housekeeping: Workmen are frequently injured by tripping, stumbling, stepping on or bumping into tools, material and other object, left lying around or by carelessly placed object falling from above.

To ensure good housekeeping the following instruction shall be followed:

- i. The place of work with in the building and around the work area in switch yard should be kept neat and clean.
- ii. Handling and usage of flammable liquids, oils, cleaning solvents should be carried out as per the prescribed manner so that they will not become the potential source of fire hazard.
- iii. The storage area should be neatly maintained and the materials should be stored systematically and in an orderly manner to prevent their falling or spreading and to eliminate tripping and stumbling hazards.

- iv. Clothing or any other types of material should never be hanged behind the space of tilt' neighborhood of substations, pole yards, buildings, oil tanks, or other structures.
- v. Pathways, stairways, fire escapes surrounding area near the distribution boards control panel etc. anti all other passage ways shall be kept dear from all obstructions.
- vi. Tools and materials should not be placed where they may cause tripping or stumbling hazards or where they may fall and strike anyone below.
- vii. Puddles of oil and water create a slipping hazard hence should be cleaned up promptly.
- viii. Nails in boards, such as those removed' from Scaffolds, forms and packing boxes, constitute OJ hazard and should be removed. The hoards should be carefully stacked or stored.
- ix. Dirty and oily waste rags should be deposited in approved container and disposed off as soon as practicable to avoid fire hazard.
- x. Broken light bulbs, glass, metal scrap and other sharp objects should be dumped in a specified place or containers provided specially for them.
- xi. Discarded fluorescent and other gas filled tubes shall be disposed off safely.
- xii. Broken insulators or other sharp edged material shall not be left in vacant lots. along the right of way or in the location where the hazard of cutting feet could be caused to men & animals.
- xiii. Line materials, tools or equipment must not be scattered around street sidewalks, highways, etc. but must be kept in a neat orderly manner, where they will not be liable to cause accident.

2.14.2 Storing and piling of Materials:

- i. Material stored in quantity should be arranged so that the weight is evenly distributed and not top heavy.
- ii. All stacks and piles should be protected against over-turning or other movement.
- iii. Barrels, drums and kegs should be stored on end or securely locked to prevent rolling.
- iv. Store the material at adequate / safe distance from the live equipments.
- v. No material or earth work or agricultural produce shall be dumped or stored or trees grown below or in the vicinity of bare overhead conductor lines so as to **reduce** the requisite safety clearances specified.

2.14.3 Lifting Carrying & Hoisting heavy object.

- i. Any person should not attempt to lift beyond his capacity.
- ii. Person should avoid twisting or excessive bending when lifting or settling down load.
- iii. Pushing should be resorted to when moving a load horizontally. rather than pulling it.
- iv. Gripping, Grasping, and Lifting with just the thumb or index fingers should be avoided & whole hand and all devices should be used.
- v. Authorized line staff working at site should wear helmets.
- vi. Manila or sisal rope sling should not be used over sharp metal corners and edges; wire ropes with padding over sharp corners and edges may be preferred.
- vii. No one shall stand or pass under any suspended load being handled by a crane, derrick.
- viii. Several work men, should not climb at the same time.

- ix. Most lifting accidents are due to improper lifting methods rather than lifting too heavy loads. When lifting heavy objects, the back should be kept close to vertical and the lifting done with leg and arm muscles rather than with back muscles.
- x. Pipe, conduits, reinforcing rods and other conducting material should not be carried on shoulder near exposed live electrical equipment or conductors.
- xi. Rope tackle and slings wherever required should be checked to ascertain that they have sufficient strength to perform the work in hand.

2.14.4 Cleaning of Parts:-With inflammable solvents

- i. Adequate ventilation must be available to avoid fire explosion and health hazards.
- ii. Avoid breathing solvent vapors.
- iii. Keep open flames and sparks away from inflammable liquids and their vapors.
- iv. Metal nozzle of a hose for spraying flammable solvents shall be grounded.
- v. Goggles and safety mask shall be used when blowing out dust with compressed air.

2.14.5 Supports & Scaffolds:-

- i. Do not stand taking support of any structure, pole equipment in the yard.
- ii. Do not use support for men, material/equipment to roles, scaffolds, Ladder, walkway or Portion of tree and any elevated structure, unless it ensures that they are firmly secure & adequate enough to take load. Do not stand by taking above support.
- iii. Scaffolding should be checked before use, for its strength, rigidity.
- iv. The footing and anchorage point for scaff holds shall be sound rigid, and capable of carrying the maximum load without settling or displacement.
- v. Carry the scaffolds/ladders carefully in the yard.
- vi. Scaffolds should not be moved before all the Material/Tools/Equipment are removed.
- vii. Authorized line staff working on suspended scaffold shall be protected by an independent life line.

2.15 FIRE PROTECTION AREAS:

1. **INTRDDUCTION:** Fire is a great destructive natural force. It can destroy vital stores, equipments, accommodation and amenities. Majority of Fires, which affect properties, are due to carelessness, ignorance, arson, lack of discipline and failure to observe statutory and general regulation. A little knowledge on this subject may save loss of lives and properties.
2. **BASIC OF FIRE:** Ordinary Fire is a chemical reaction between a fuel and oxygen in presence of heat. In other words, it may be stated that three things are essential to initiate a Fire viz. OXYGEN, FUEL & HEAT which can be represented as three arms of a triangle. The triangle is known "Fire Triangle". A Fire cannot take place in absence of any one of these three factors. In extinguishing a Fire, all that is done is to break any of the arms of the "Fire Triangle" removal of Heat or Fuel or Oxygen from Fire.

3. **METHOD OF EXTINCTION:** Whatever may be the equipment or extinguishing media for fire fighting, the three under mentioned method are used:

- i. **Cooling Method:** The method, in which Heat of burning substance is removed, generally by using water, is known as cooling method. Water brings the heat of substance under Fire below the ignition temperature of substance. This method is normally applied till extinguishing Fire of solid combustible materials.

This method must not be adopted for fighting live electrical Fire. This method is applied for extinguishing electrical originated Fire only after ensuring the cut-off of power supply.

- ii. **Smothering Method:** The method in which Oxygen is removed from burning substance is known as smothering method. In this method oxygen is restricted to Fire by using layers of Foam or inert gases like CO₂, Nitrogen, Chlorofluoro carbon or Dry Chemical Powder or Dry sand. Sometimes this is achieved by proper blanketing of Fire using Fire blanket or Asbestos blanket or Aluminum blanket or other available non-combustible materials. This method is normally used for extinguishing Fire in Flammable liquids.
- iii. **Starvation Method:** The method in which Fuel or combustible material is removed from Fire is known as starvation method. This is achieved by removing burning substance from the scene of Fire. Fire in pipe lines, cylinders. Tankers containing flammable - liquid or gas is controlled by closing the valves. By closing valves the fuel or combustible materials are isolated from Fire and thus starvation is achieved. This method is best used for extinguishing Fire in pipelines, cylinders containing flammable liquid or gas.

4. **CLASSIFICATION OF FIRES:**

Fires are categorized in to four different classes mentioned below:

- i. **CLASS -A:** Fires involving solid materials normally of organic nature are categorized as Class -A Fire. Fire in paper, wood, cotton, plastic. rubber etc. are the example of Class-A fires. Cooling method is normally used for extinguishing Class-A Fires.
- ii. **CLASS -B:** Fires involving flammable liquids or liquefiable solids are categorized as Class-B Fire. Fires in petrol, kerosene, diesel, oil etc. are the examples of Class -B Fires. Smothering method is normally used for extinguishing Class-B Fires.
- iii. **CLASS -C:** Gaseous Fires are categorized as Class ~ C Fire. Fires in LPG, Acetylene. natural gas etc. are the examples of Class-C Fires. Starvation method is normally used for extinguishing Class-C Fires.
- iv. **CLASS -D:** Fires in metals are categorized as Class-D Fire. Fires in Sodium. Magnesium, Potassium etc. are the examples of Class-D Fires. A special type of powder is used for fighting Class – D Fires. There is no chance of Class-D Fire in Sub-Station.

2.16 FIRE EXTINGUISHERS: It is very easy to extinguish a Fire when it is small. If Fire is not controlled in its incipient stage, then it may require lots of manpower, time and money to control. Hence, it is better to attack Fire whl'1l it is small.

To extinguish small Fire, Fire Fighting extinguishers must be kept at the strategic locations in all the Sub-Stations. This can be easily identified by its red colored and cylindrical in shape. These Fire extinguishers must be used for extinguish small Fires by an authorized line staff nearest to it. Therefore, the operational knowledge of Fire extinguishers is inevitable for each and every authorized line staff working in Sub-Station.

There are various types and capacities of Fire extinguishers provided in Sub-Stations. These Fire extinguishers should be operated on Fire according to their suitability. Before operation, it is very important to read the information given on the sticker of a particular Fire extinguisher:

- i. The name of Fire extinguisher is written on bold capital letters on the sticker By name, the inside contents and discharge of Fire extinguishers can be identified. The following are the examples of names and contents of Fire Extinguishers:

S. No.	Name of Extinguisher	Contents	Discharge
1	Water Co ₂ type	Water & Co ₂ gas cartridge	Water
2	Co ₂ type	Co ₂ gas	Co ₂ gas
3	Dry Chemical powder (DCP)	Powder (Normally sodium bicarbonate) and Co ₂ gas cartridge Powder	Powder
4	Mechanical Foam	Water mixed with Foam compound.	Foam
5	Halon Type	Halon Gas (Normally Bromo Chloro Difinoro Methane)	Halon gas

- ii. The information regarding suitability of Fire extinguishers is given in form of capital letters in circle. If character 'A' is written inside the circle then it is suitable for Class-A Fires. If characters 'B' & 'C' are written then it is suitable for Class-B & Class-C Fires.
 - iii. The method of operation of Fire extinguishers varies from type and capacities. It is, therefore, essential, to read carefully the method of operation written on the sticker of particular Fire extinguishers. A stepwise drawing for operation is also shown.
- The date of checking and due date of checking must be checked before the operation of Fire Extinguisher. It must be ensured that the Fire extinguisher is well maintained and ready for use.

Chapter-3

SAFETY RULES FOR AUTHORIZED LINE STAFF

3.1 General: No authorized line staff shall start to do any hot-line maintenance work without first assuring himself that he thoroughly understood the work to be done and the method of doing it. In case there is any doubt in his mind, he shall ask the Forman / JE incharge and receive the required information from him.

1. The authorized line staff shall at all time keep parts of his body as far as possible from the tool end of the stick. On poles with vertical formation with or without tapings, where there is an abundance of hardware, rubber gloves should be used while changing out dead-end disc to eliminate the effect of static discharges.
2. Authorized line staff shall see that their safety belts are properly fastened before they start work.
3. When in doubt concerning the strength of the tool or piece of equipment, it should not be used.
4. Hot-line maintenance tools shall not be carried up poles or towers in safety belts but tool bags or hand lines shall be used for this purpose.
5. The authorized line staff must be certain, before he attempts any work, that his companions or the pole thoroughly understand the work to be done. Conversation should be limited to the necessary remarks concerning the work. No conversation, not pertinent to the work, shall be permitted.
6. The authorized line staff shall not change the position on the structure without informing his fellow authorized line staff as to what he intends to do.
7. Under no circumstances should an authorized line staff depend upon another authorized line staff to hold a live conductor clear of him permanent anchors must be used for this purpose. When blocks are under strain, the ropes must be secured snubbed. It is not permissible to snub to a truck or to a trailer.
8. No knots of lesser security than "two half hitches" shall be used in tying off various lines. Where a line is to be subjected to a strain, a "turn-around" shall be taken around the snub and the completing knot shall be "two half hitches". When joining two lines of the same size temporarily to take strain, a square knot shall be used. If two lines are to be joined permanently, a spliced joint shall be made. When a loop is to be made in the end of the line, a bow line knot shall be used.
9. When removing tie wires, these shall be rolled into a ball or cut short as soon as they are unwound so that under no circumstances will they be long enough to reach a ground or another conductor and to endanger the authorized line staff. During the installation or the removal of tie wires, an authorized line staff shall steady the conductors on the insulator with a proper tool. Tie wires shall never be used a second time
10. When moving live conductor, the authorized line staff shall stay below the conductor that is being moved until it is thoroughly secured in a safe working position. Blocks shall be used on the end of the hot-line tools so that the conductor may be moved slowly and carefully.

11. When working on lines paralleling or crossing roads or highways, special attention shall be paid to securing adequate clearance for all moving vehicles.
12. Hot-line tools shall never be placed directly on the ground as it is possible that they might absorb moisture which would reduce their dielectric strength.
13. Authorized line staff must at all time take extreme care in transporting and using tools so as not to damage them.
14. All tools used on each job shall be carefully inspected before **and** after the work is done.
15. All tools, when not in use, must be kept in canvas bags or weather-proof boxes provided for that purpose. Care should be exercised to see that tools kept in these bags or boxes are stored in a dry and, if possible warm place. Wooden sticks should be inspected regularly, dried out and thoroughly maintained at intervals, depending upon the extent of use and exposure.
16. Hot-line maintenance work shall not be hurried. The job should be done safely even though it takes more time.
17. The authorized line staff should avoid wearing rings, wrist-watches, identification bracelets, etc. when engaged in hot-line work.
18. Rubber-Gloves should be worn when within reach of the live conductor.
19. Ground wire should either be covered by rubber goods or lowered down to a safe working distance; it should be ensured that it does not contact with any lines below. Rubber gloves should be worn when disconnecting and connecting ground-wire.
20. Do not throw tools or materials to or from authorized line staff on pole.
21. Ground man must maintain safe working distance from poles.
22. Safety hats should be worn by the entire authorized line staff while engaged in hot line work.
23. Suggested working clearances are as follows;

Line Voltages (kV)	Min. Clearances (In Meter)
2.2 to 6.6	0.305
11 kV	0.610
33 kV	0.71
66kV	0.91
110 kV	1.02
220 kV	1.52

The working clearance gives the minimum safe working distance from the conductors or from the hot end of Hot-Sticks to the authorized line staff. In General it is a good practice to maintain a working position so that no conductor, regardless of voltage is within the reaching distance of a authorized line staff.

24. Maintain steady pull on fall lines or hand line or set of blocks; do not jerk.
25. Never tie hand lines, fall lines, snuh lines to truck or other vehicles.

26. Do not use rope directly on conductors carrying over 5000 volts without separating the rope from the conductor by a link stick.
27. Be sure that temporary anchoring devices will handle the strain placed on them.
28. Be sure that temporary lines are tied securely to anchors and that they are placed in such a position that they will not interface with the work in progress or be accidentally loosened.

3.2 Safe Working in Sub-Station:

3.2.1 General Safety Instructions:-

- I. Danger signs should be displayed to warn person, the presence of high voltage equipment.
- II. Gates in switchyard fences and doors to bus compartments and other enclosures containing live equipment should be kept locked at all times except when authorized line staff are working inside.
- III. Unauthorized person should not be allowed inside a hazardous operation area like a bus compartment, switchyard etc. unless such person is accompanied by a responsible authorized person, who shall always be present while such person remains in the area. Any person deputed to clean the floors or parts of the plant in such areas must be given clear instructions and a responsible person must be present while the man is carrying out the work to ensure that the man does not endanger his own safety.
- IV. Before doing any work on rotating equipment. it should be shut down and properly disconnected from power source.
- V. Care should be taken to prevent clothing, wiping cloths, waste dusters, oil cans or tools from getting caught in the moving parts of machinery.
- VI. When using compressed air on live electrical machinery, an insulating hose and nozzle should be used. Dust proof goggles and safety mask should always be used when cleaning with compressed air. Compressed air should never be used for cleaning or dusting clothes or any part of the body.
- VII. If authorized line staff are working on H.T. (voltage above 650V) equipment. the area safeguarded for work shall be cordoned off by tying a white rope or cotton tape all round and danger boards shall be fixed within the safe guarded area at various location with the inscription facing the safe working area to warn the other line staff/ personnel not to cross over the area with live equipment during the progress of work.
- VIII. It should be ensured that maintenance and repair works are done properly before the equipment deteriorates further and become a source of danger. It shall be also ensured that defective equipment is not retained in operation till they are rectified.
- IX. It should be ensured that the appropriate and proper tools are used for maintenance and repair. These tools should be periodically checked and if defective, must be rectified before using them again or condemned, if beyond repairs.

- X. Live disconnecting switches and fuses should not be opened or closed by any other means than the stick or operating gear provided for this purpose. The authorized line staff using the switch stick should ensure himself of a secure footing and proper clearance from other equipment and should wear rubber gloves of adequate insulating value for the voltage of the disconnecting switch or fuse and in good condition

3.2.2 Sub-Station layout diagram & Equipment numbering:

1. A list should be prepared and put at a prominent place in the Sub-Station Control Room showing all essential safety equipment and T&P to be maintained.
2. The numbering and identification of sub-station equipment and bus arrangement should be standardized and used consistently. All equipments shall have number and identification according to the scheme only. The numbering in the switchyard and in the control panels should be same to avoid possibility of any misunderstanding. The single line diagram in the control room shall have same numbering arrangement and should be as per SCADA nomenclature.
3. Single line schematic diagram (SLD) of the sub-station shall be put in the control room at prominent position. The SLD should indicate the bus and feeder arrangements with all associated equipment in the Sub-Station. The Single line diagram shall be updated for any change /addition to the Sub-Station.

3.2.3 Transformers:

1. All transformer installations shall comply with the provisions of IS 1646: 1982 in addition to the following:
 - As a protection against excessive damage due to occurrence of faults, transformers fitted with conservators shall be protected with Bucholz Relay.
 - All transformers shall be equipped with oil temperature alarms or excess current relay protection.
 - The bushings, insulators, and contacts of taps changing gears shall be kept scrupulously clean at all times.
 - The level and dielectric strength of the transformer oil shall be checked at periodic intervals, and in the event of presence of a large quantity of sludge the oil shall be renewed.
2. In addition to the usual cable clamps above floor level, cables shall also be clamped immediately below floor level, each cable or group shall, where possible be protected by a pipe or cover of heat resisting material rising to a height of at least 45 cm above floor level or terminating just below cable gland, sealed at the bottom and filled with sand or small pebbles.
3. Whenever possible, all jute shavings shall be removed from cables in switch rooms, basements and tunnels.

4. Where cables rest on the floor of tunnel or basements, they shall be separated into groups by vertical barriers of tile brick, or concrete and the trenches so formed shall be filled with small pebbles. Alternatively, the cables may be separately clamped and each cable run shall be separated by a minimum clear space of 75 mm.
5. The cable shall not be routed near hot steam pipe, turbine, and pulverized coal pipe and near hot gas ducts. Wherever it is unavoidable fire resistant cables shall be used.
6. Power cables and control cables shall run in separate trenches, wherever possible.

3.2.3.1 Fire Protection of Transformer

1. No fixed fire protection equipment (such as high velocity spray) is required on transformers below 10 MVA or in the case of oil filled transformers with oil capacity of 2000 liters and below. For all other transformers high velocity water spray system, shall be provided. This system shall be separately mounted and designed to take into account the possibility of a transformer explosion. The water spray deluge valve house shall be located outside the transformer fire zones and protected from radiant heat and other fire effects. The actuation of this system shall be automatic but manual operating valves shall also be provided.
2. The high velocity spray system for the transformers should be well designed to have adequate coverage of the entire transformer unit including the conservation tanks, the bashings and the bottom area. The positioning of the nozzles should be such to protect all surfaces of the transformer and to give standard discharge rate for the system to be protected. The automatic high velocity water spray shall be of pre-active with quartzoid bulbs.
3. Fire barriers walls shall be provided between transformers where they are less than 15 m apart or where the oil capacity exceeds 2000 liters.
4. The transformer shall be so designed as in permit the safe testing of the fire protection system, with discharge of water, while on load.
5. There shall be arrangements for containment of the spilled oil. For large transformers the drainage system as well as storage pit shall be sufficient to accommodate at least the total volume of the oil and as allowable volume of fire fighting water. The drain pipes shall be provided with standard type of flame arresters.
6. The fire protection systems covering the transformers, associated oil conservator tank and cooler batteries shall be designed to meet the single risk concept so that simultaneous deluge over all the three risk zones is possible.

3.2.3.2 Maintenance work on Transformers:

- When work is to be carried out on a transformer, both the low and high tension (Primary & secondary sides) breakers and isolator shall be opened. Similarly when isolating transformers to which potential transformers are connected, such potential transformers shall be isolated and secondary P.T. fuses removed to prevent any possibility of transformer being made alive through synchronizing or voltmeter plug.
- Before commencing any work on a transformer, the transformer winding should be discharged to ground. In case the transformer is isolated from the supply by single point (jif disconnection e.g. fuse, the transformer shall be safeguarded by shorting the phase terminals together and connecting them to ground. before commencing any work.. The neutral ground of a transformer should never be treated as the grounding of phase terminals, as required above.

3.2.4 Work on Circuit Breaker:

The Following Precautions shall be taken before commencing the maintenance work in the Circuit Breakers:

1. Breaker must be open before any disconnections.
2. It is to be ensured that line and bus isolators are open and there is no back feed from potential transformers and interlocking should be ensured.
3. Main fuses at the switchboard/panel should be removed and D.C. voltage must be disconnected from breaker mechanism.
4. Tools and equipment should be in safe working condition.
5. In outdoor HV or EHV breakers work must be done from Ladders or platforms alongside the breaker. Energized overhead conductors are dangerous for workmen to stand on these breakers. Essential work may be done from the top of the breaker only if protective barriers have been installed.
6. Do not operate the breaker by solenoid or other operating mechanism without oil in the tank, as this will damage the breaker mechanism.
7. When working on the mechanism with the breaker-dosed, wire the trip latch or block the breaker closed so that it cannot be tripped accidentally. Be sure that auto reclosure feature has been by-passed during maintenance work.
8. In case of ABCB and other pneumatically operated circuit breakers the circuit breakers should be closed after opening the isolators on both sides, to prevent fall of pneumatic pressure.
9. After maintenance work is over the breaker should be operated by relay operation as test check. This ensures safety of the system for future faults.

3.2.5 Isolator Operation. Earth Switch Operation:

1. The Circuit Breaker shall be open/off.
2. The isolators should not operate (open or close) on load in any case.
3. The isolators should not be operated (open or close) on charged line / transformer in any case.

4. After opening isolator be sure that there is no pole stuck and all three poles of the isolators have been opened fully.
5. After closing isolator be sure that all three poles of the isolators have been closed.
6. The isolator should be locked with pad lock and key after opening on PTW and should be closed when PTW is returned properly.
7. When PTW is given for work on line the Earthing switch is closed after opening the isolator and both should be locked in position till returned of PTW properly.

3.2.6 Instrument Transformers Operation:-

1. The instrument transformers should be grounded.
2. One lead of the secondary circuit of the current transformers should be connected to ground at all times when the C.T. is in service.
3. Potential transformer secondary should never be shorted to ground except at star point.
4. The low voltage winding of potential transformers should always have one side permanently and defectively grounded.

3.2.7 Capacitors:-

1. Every capacitor shall be treated as 'hot' until proved otherwise. Capacitors store energy and are not necessarily dead when disconnected from the lines. Once charged, a capacitor may retain this charge for several hours even after it has been disconnected.
2. Before commencing work on the capacitors, first open all cut-outs or disconnecting devices to the capacitors and then wait for at least five minutes for the internal resistor to reduce the voltage. Next use a hot stick, short circuit and ground all terminals of the capacitor. The short circuit grounding Jumpers should be left attached while work is being done on the capacitor.
3. To place the capacitor banks in service, first remove the jumpers with hot sticks and then close the cut-outs.

3.2.8 Precaution while Maintenance of Battery:

1. While preparing electrolyte for initial filling up in the new battery always remember that the acid should be poured into water slowly and not the water into acid as it may splash acid on face or eyes.
2. Water should not be poured in concentrated acid as this will lead to chemical explosion.
3. If the acid is splashed in the eyes, immediately flush eyes with water, followed by Olive Oil. If irritation does not subside bathe eyes with zinc and rose water lotion in eye glass.
4. If the acid is drunk by mistake, take a drink of soap suds and baking soda in a glass of water and get medical advice as soon as possible.
5. Don't take open flame near the battery especially while it is being charged.

3.2.9 D/C distribution:

1. D/C Distribution Board (DCDB) /Battery Charger must be cleaned regularly. Connections must be Tight / Rigid.
2. Only H.R.C. fuses of adequate and correct rating shall be used. Maintain the stock in the site store.
3. On DCDB, every DC feeder DC Cable provided for bay shall be named separately.
4. Separate Room shall be provided for DC distribution system in tile substation.
5. AC power cables & DC control cables shall be run separately in cable Trench as soon as possible.
6. Do not pull out the control cables with force & Jerk.
7. The defective cable shall be removed from Trench. Both ends of the cable must be made free first, pull the cable gently /smoothly, without disturbing other live cables.

3.2.10 Protection for EHV Sub Station:

1. The licensee/ utility/ company shall provide & maintain appropriate protective relays at 33kV and above S/Stn. including all the 33 kV & higher voltage transmission lines. The protective relays will also be provided on 11 kV outgoing feeders from the entire source S/Stns.
2. All protective relays shall be tested for their proper operations at least once every year & record of such testing will be maintained.
3. Record of mal-operations or non-operations of all protective relays shall be maintained. After every such mal-operation investigation for its causes will be carried out & remedial measures will be taken.

3.2.10.1 EHV substation shall maintain following T&P (minimum) for safe working:

1. Ten sets of discharge rods.
2. Good quality Torch (4 no) with fresh cells.
3. First Aid Box.
4. Tool Box (2nos) containing Insulation, Tape, all size ring & flat spanners, Allen key set, pliers (big, small size) Insulation cutter etc.
 - a. H.R.C. fuses of various capacities.
5. Ladder (4nos.).
6. Ropes.
7. A/C Distribution Board with adequate wiring set.
8. Tong Tester.
9. Megger (5kV).
10. Multi meter with cords.
11. Danger Boards.
12. Good quality rubber (hand) gloves.

- For fast and effective communication (in case of accident), the following phone numbers shall be readily available
 1. Police station of concerned Area
 2. Ambulance service
 3. Govt. Hospitals (near to 5/5)
 4. Fire brigade station
 5. Electrical Inspector
 - 6. Mobile No. of following:**
 - I. Substation in charge
 - II. Fire drill head of the substation
 - III. Ambulance service
 - IV. Fire brigade
 - V. Security head

Chapter-4

Safety Devices and Equipments

4.1 Safety Devices and equipments:

The following Safety Devices and equipments are required:

1. Rubber Hand Gloves, Gauntlets (11 kV class).
2. Safety Belts.
3. Leather Protective Gloves
4. Hand lines.
5. Ropes.
6. Helmets.
7. GOS Rods (11 kV Insulated).
8. Goggles.
9. Fiber Ladder.
10. Rubber Mat.
11. Telescope earthing rods.

12. Hand Tools:-

- I. Insulated Cutting Pliers.
- II. Insulated Screw Drivers.
- III. LT Line Tester.
- IV. Adjustable Spanner.
- V. Rain Coat.
- VI. Chargeable Hand Torch.

4.2 Workmen's Safety Devices:

- I. Rubber gauntlets, gloves, mats, boots and galoshes, insulated platforms and stools, safety belts, hand lines, tower wagons and other special insulated devices shall be used as required by authorized line staff working on electrical apparatus. Underground mains and overhead lines as precaution against accidental electric shock.
- II. Pliers and other tools insulated with brittle materials or otherwise liable to have the insulation damaged when in use, shall not be used.
- III. The Supervisor in charge of the work will be responsible to test and ensure proper use of the safety equipment. supplied to the gang of workmen under him and see that it is maintained at all times in efficient condition and must immediately bring to the notice of his superior officer any equipment which is liable to be broken in use, when arrangements will be made immediately for their replacement.

4.3 Authorized line staff /lineman's, fitter's oil cable jointer's clothing

Authorized line staff while working on lines shall avoid wearing loose clothing, rings, metal chains etc., which may (contact a live portion and cause hazard. They shall use rubber gloves, safety shoes, head gear, goggles wherever available

4.4 Responsibility in using safety devices:

IT is the responsibility of the authorized lint:' staff to make use of safety devices properly.

4.5 Rubber gloves and gauntlets:

Rubber gloves should not be rough handled as to be damaged. After the work they should be cleaned and powdered with French chalk and stored in a safe place.

4.6 Testing rubber gloves and gauntlets:

Before using, the gloves should be checked for cuts, weak spots and pin holes. by an "Air Test". This is done by rolling the gloves tightly from the gauntlet end, and noticing if any air escapes. If air leaks the gloves should be discarded. If the either hand glove is found to be unserviceable the pair itself should be discarded.

4.7 Care of rubber equipment:

Rubber equipment shall be kept clean and free from oil. They should not be stored near a "source' of heat, or exposed unnecessarily to sun's heat. They are best stored in protective containers, and should not be tied by cords or thread, which may cut it.

4.8 Use of Rubber gloves should be insisted:

1. When inspecting the Transformer or its H.T. & L.T. leads.
2. When connecting wire near a live conductor equipment.
3. While removing or replacing fuses of H.T. installations.
4. A combination of glove and hickory rod or fuse pole rods should be used where the voltage exceeds 5,000 volts.
5. While opening and closing Isolators.

4.9 Care of safety belts: Safety belts should be properly handled, and periodically treated with oil to prevent its becoming hard. Care should be taken to see that sharp tools or edges do not cut dents and holes in it. Extra holes should not be punched as it weakens the belt. It is best preserved in a separate case.

4.10 Leather protecting gloves: Protective leather gloves may be worn over rubber gauntlets when wires are being spliced or when solder or hot compound are being handled when it is necessary for the authorized line staff to move about a lot during working or when line wire are being tied on to insulators or when any other work is being done which might render the gauntlet liable to tear and consequent danger to the wearer.

4.11 Eye and face protection: Necessary eye protection should be used while operating the switches on load to avoid injury to the eyes due to sparking. The eye protection should be used during handling molten solder, handling the acids and electrolyte in the battery room.

The eye and face protection should be inspected by Foreman / JE Incharge at frequent intervals by the user and should be replaced immediately when the first sign of damage is observed.

4.12 Head protection: Safety head gear shall be worn by the authorized line staff whenever there is a hazard of falling objects, or electrical contact or any other cause which may lead to head injury. Hair should not pose any obstruction to work and also should not lead to any accident during the work.

Head protective gear should also be subjected for inspection level very frequently and should be replaced immediately when the sign of damage or deterioration is noticed.

4.13 Hand lines: Hand lines should be twice as the height where work is being done. They should always be kept clean and dry, free from grease, solder, oil, etc., ends should be tied to prevent unraveling of the strands. Hand lines should not have metal reinforcement. When jointing the hand lines a splice should be made. No metallic clamps or wire should be used for joining. Hand line should be carried up a pole, uncoiled and attached to the body belt. The hand line must be strong enough to carry the weight of an authorized line staff. Hand lines should not be allowed to become wet, and should be dried before being stored. A spare hand line should always be available in an emergency. Hand lines should be kept away from street and vehicle traffic.

4.14 Ladders:

1. Ladders must be of strength to carry double the strain of the heaviest load that would be placed upon them.
2. Defective ladders must never be used.
3. A clearance space of not less than 12" must be provided between ladder rungs. A minimum clearance space of 36"/90 cms must be provided in front of ladders where space permits.
4. When straight, portable ladders are used on hard surfaces, they must be held or firmly locked in position, anti-slip shoes must be used where provided.
5. Ladder may not be placed against unsafe place.
6. Ladders must be kept free from dirt, grease and paint-spots.
7. Ladders must be stored upon brackets and in sheltered locations.
8. Ladders must not be placed in front of doors opening towards the ladder or against window sashes.
9. Step-ladders must be fully opened before being used.
10. Two ladders must not be spliced together.
11. Authorized line staff must face ladders when ascending or descending over them and must have both hands free.
12. Authorized line staff must not slide down or try stunts on ladders.

13. Ladders must be periodically inspected, when found defective; they must be repaired or disposed off.
14. Straight, portable ladders must be placed at safe angle about 75 degrees with the horizontal. In other words, place the foot of a 12'4 Mts ladder 3'1 Mts. from the object it leans against.
15. Straight ladders shall not be climbed beyond the third step from the top.
16. Authorized line staff shall use the safety belt tied to the ladder whenever both hands must be used for the job or a possibility of the authorized line staff falling from an elevated position exists.
17. As far as possible portable metal ladders shall not be used in the vicinity of exposed energized lines and equipment.
18. Only One authorized line staff shall work from a ladder at one time. If two authorized line staff is required, a second ladder shall be used.
19. Ladders are not meant to be used as scaffolding platforms.
20. Other makeshift arrangements for the purpose of ladders like using boxes, chairs. etc., shall not be resorted to.
21. Use of step ladders above 20 feet is prohibited and the use of extension ladders above 24 feet is discouraged.
22. Step ladder legs shall be fully spread and the spreading bars locked in place.
23. Step ladders shall not be used as straight ladders.
24. When an authorized line staff is working on a step ladder more than 10 feet high the ladder shall be held by another authorized line staff.

4.15 Ropes:

1. Fiber ropes are made principally of manila fiber, sisal fiber and hemp. Frequent inspections are required in the use of rope as the interior fibers may be broken or ground to powder, while the exterior fibers may indicate that the rope is little worn.
2. Pure manila rope is the strongest and most reliable of fibers ropes. It is of a yellowish color with silvery or pearls luster and has a silky feel when drawn through the hand. Rope with brown or black fiber is of inferior grade.
3. Sisal rope has about 6.7% of the strength of manila rope. It is-yellowish white, sometimes with a greenish tint. The Fibers are hard and stiff. with a tendency to splinter:
4. Hemp rope is nearly as strong as manila and is slightly more resistant to atmospheric deterioration. It is of a dark grey color and is much softer than manila rope.
5. Rope must be so uncoiled as to avoid kinking, since even a moderate strain on a rope in which there is a kink may over-stress the fibers at the kink.
6. Wet rope deteriorates rapidly unless dried properly. It should be hung up in loose coils so that dry air can be circulated through them. Heat should never be applied as it dries out the oil and thus shortens the life of the rope. Wet rope has a tendency to form kinks. No load should be applied until all kinks are removed.

7. All ropes are easily damaged by acids and alkalis. Any rope known to have been exposed to acids or alkalis (sometimes indicated by discoloration or strains) should be used with caution.
8. In making a rope fast, an object with a smooth round surface should be selected. When rope is running over a sheave or pulley internal wear is caused by friction. The life of the rope is greatly prolonged by using blocks with sheaves of large diameter.
9. Fiber rope should always be cleaned before being placed in storage and shall be stored in a dry, airy place. It should never be stored in the same room with acid or caustics.

4.16 Hand Tools:

1. All Hand tools to be used should be of an approved type.
2. Tools shall be inspected at frequent intervals and disposed off as soon as the sign of damage is observed.
3. Using hand tools improperly, neglecting to keep them in safe working condition and carelessly leaving them around where they may endanger authorized line staff and frequent cause of accidents. Proper tools should always be used for the work.
4. All tools shall be maintained in good working conditions. Burred heads shall be promptly redressed. Broken, cracked or otherwise damaged handles shall be replaced. All tools with sharp edges should be kept in sheaths, shields, tool chests or other containers, when not in actual use.
5. A screw driver should never be used as a chisel. Screwdrivers with full length metal tong of shank through handle must not be used for electrical work. Other tools such as pliers, wrenches, etc., whether insulated or not, shall not be used without rubber gloves while working near live parts of any voltage.
6. All files shall be fitted with substantial handle; workmen should keep files cleaned as this reduces the slipping hazard and prevents skinned hands.
7. Never use metal tapes, rulers, or cloth tapes with metal strands or wood rulers with metal ferrules or joints near energized equipment.
8. Avoid use of long saws among wires as a short circuit may be caused.
9. Belt-tools must be well secured to the belt. Only pliers, hammers, wrench and connectors should be carried. All other tools should remain below until needed and then hoisted in bag/tool buckets or firmly attached to hand lines.
10. Chisels, drills, punches, ground rods and pipes shall be held with suitable holders or tongs (not with the hands) while being struck by another authorized line staff.
11. Shims shall not be used to make a wrench fit.
12. Wrenches with sprung or damaged jaws shall not be used.
13. Pipe shall not be used to extend a wrench handle for added leverage unless the wrench was designed for such use.

14. Wooden handles those are loose, cracked, or splintered shall be replaced. The handle shall not be taped or lashed with wire.
15. All cutting tools such as saws, wood chisels, drawknives, or axes shall be kept in suitable guards or in special compartments. The insulation on hand tools shall not be depended upon to protect users from electric shock.
16. When using such tools as screwdrivers and wrenches, authorized line staff should avoid using their wrists in a bent (flexed), extended or twisted position for long periods of time. Authorized line staff should maintain their wrists in a neutral (straight) position.

4.17 Portable Electric Tools:

1. All portable electric power tools such as drills, saws and grinders on requisition from authorized line staff to be issued to authorized line staff. They should have an earth conductor connected effectively with the earth when energized.
2. The power supply cord should be inspected at regular intervals.
3. They must be used to their capacity in accordance with the manufacturer's instructions.
4. Electric tools should not be used in areas where there is a flammable atmosphere.
5. All portable power supply systems like vehicle mounted generators shall be protected by an Earth Leakage protection.
6. Protective guards should be used wherever possible and provided.

Chapter-5

EARTHING

Grounding /Earthing is provided to connect some parts of electrical equipment, installation or the neutral point of power system. This provides dispersing path for fault current and lightening current in order to stabilize the potential and act as a zero potential reference point to ensure the safe operation of the power system, electrical equipment and safety of power system operator and other persons.

Grounding is achieved by the grounding devices buried in the soil. The grounding devices of a power system can be divided into relatively simple one for transmission towers/poles such as pipe earthing or counterpoise earthing by horizontal grounding electrode or vertical electrode or by grounding grid for an S/Station power plant.

5.1 Classification Earthing can be classified as under:

- i. **Working grounding/Neutral earthing:** It is done to reduce the voltage stresses due to switching and lightning surges and to control the fault currents to satisfactory values.
- ii. **Protective earthing:** When the insulation of electrical equipment fails, its enclosure becomes live and the person feels a shock if he or she contacts its enclosures. In order to guarantee the personal safety the enclosures of all the equipments are to be grounded.
- iii. **Lightning protection earthing:** In order to provide safety from lightning to human beings and power system this type of earthing is done by providing Surge lightning and other lightning protection arrestors which are connected with the grounding system.
- iv. **Functional earthing:** The functional earth is used for interference suppression. It is a low-impedance current path between the circuitry and earth and is only used to improve the equipment's performance and not for protective~ purposes. Functional earth should be established for the low frequency and the high frequency range. At the low frequency range the most important factors for a satisfactory functional earth are the cross section area of the earthing cable and the cable length to ensure minimum over-all cable impedance. At the high frequency range a short cable length, high outer conductor surface (skin effect) and low inductance are important.

5.2 Purpose of Earthing:

1. Reducing insulation level of Electrical Equipment
2. Ensuring safe operation of Power System.
3. Ensuring personal safety.
4. Eliminating Electrostatic accidents.
5. Detecting grounding faults.
6. Equipotential bonding.
7. Reducing electromagnetic interference.

5.3 Temporary Earthing: This section covers the detailed procedures for providing temporary earths for the protection of workmen and property while carrying out operation and maintenance works Oil the already existing lines or construction of new lines for the protection of workmen and property.

5.3.1 Temporary Earths: Temporary earths are those applied at the actual location of the work, during repair or construction of installations, for the protection of workmen and property.

Following feature of temporary earthing equipment shall be kept in view by authorized line staff using it.

Earthing devices shall be of approved types, comprising properly designed clamps attached to insulated sticks of sufficient lengths to enable the clamps to be securely clamped to the conductors being earthed without an authorized lin' staff's hand approaching closer than the minimum safe working distances, each such line clamp is to be connected by a flexible copper earthing lead or of equivalent copper section of aluminum cable to an adequate earth clamp or other device for attaching to permanent a connection or to a temporary earthing spike. The earthing should be connected to clean rust free nut bolts of tower / Earthing Electrode.

All earthing jumpers shall be of annealed bare and stranded copper equivalent aluminum conductor. Earthing leads for use at substations and lines shall have a cross section of at least 0.645 sq. cm (0.1 sq. inch) copper equivalents.

Least 1.905 cm (3/4") in diameter and 1.524mtrs. / (5ft.) in length. These shall be of conducting earthing rod electrode material and be driven to a depth of at least 0.914 meters (3ft) in a spot considered to give good earth.

Grounding cable/Earth wire used for earthing shall be examined by the authorized line staff every time before use.

5.3.2 General precautions to be taken in connection with the application of temporary earths:

1. Before doing any work on dead lines Or equipment where there is a possibility of their becoming energized from any source, such line or equipment should be grounded between the location of work and all possible sources of energy.
2. Temporary grounding cables shall be flexible standard copper/aluminum not less than No.1/0 AWG (0.590 inch) and shall be equipped with approved clamps at each end.
3. When grounding lines or equipment the connection to the ground shall be made first and that to the circuit or equipment last. In removing grounds, first remove the connection to the circuit or apparatus and then remove the ground connection. Approved discharge rods should be used in making ground connection to the circuit or apparatus.
4. Where two or more crews of authorized line staff are working independently on same line or equipment, each crew shall properly protect themselves by placing their own temporary grounds.

5. No electric apparatus or line shall be earthed until all reasonable precautions have been taken to ensure that it has been disconnected from all sources of supply.
6. The connection for earthing of an apparatus or line shall be applied or removed only by competent authorized line staff.
7. When it is necessary to cut a line, bus bar or loop or to repair a broken conductor or damaged loop, earths shall be placed on both sides of the work. When removing earthing leads, they shall be disconnected from the line conductor first and the earth system last. The removal shall be carried out in a reverse order to that adopted for the connection of various conductors to earth.
8. All works on dead circuit shall be done between two sets of temporary earths.
9. Y. Earths shall never be attached or removed with bare-hands, Rubber gloves, gauntlets or approved protective equipment shall always be used.
10. In so far as practicable, the authorized line staff applying the earth's connection on poles and structures shall maintain his position below the level of conductor to be earthed in order to keep the body away from any live part when the earthing device is applied.
11. No temporary earth shall be removed from the equipment while the work is in progress.
12. Authorized line staff shall not touch any conductors from which protective earths have been removed.
13. Earthing of one conductor does not render other conductors safe for work. All phases shall be earthed even if work is to be carried out only on one phase.
14. Temporary earth connections should not be connected to neutral wire, guy/stay wire or any other metal part of the structure.
15. The meaning of temporary earth is that it is done for the purpose of carrying out the specific work by creating a safety zone for the protection of working authorized line staff from electric shock.
16. The temporary earthing connection to the lines should be as close to the point of work as possible.
17. High voltage mains shall not be worked upon unless they are discharged to earth after marking them dead and are earthed and short-circuited with earthing and short-circuited with earthing and short-circuiting equipment adequate to carry possible short-circuit currents and which are specially meant for the purpose. All earthing switches wherever installed should be locked up.
18. The earthing device when used shall be first connected to an effective earth. The other end of the device shall then be connected to the conductors to be earthed.
19. Except for the purpose of testing, phasing, etc. the earthing and short-circuit device shall remain connected for the duration of the work.
 - i. Removing the earth connections -On completion of work-removal of the earthing and short-circuiting devices shall be carried out in the reverse order to that adopted for placing them that is, the end of the earthing device attached to the conductors of the earthed mains or apparatus

shall be removed first and the other end connected to earth shall be removed last. The conductor shall not be touched after the earthing device has been removed from it.

- ii. Safety precautions of earthing -The precautions mentioned in (a) to (e) below should be adapted to the extent applicable and possible.
 - a) Examine earthing devices periodically and always prior to their use.
 - b) Use only earthing switches or any other special apparatus, where provided for earthing.
 - c) Verify the circuit is dead by means of discharging rod or potential indicator of approved type. The indicator itself should first be tested on a live circuit before and after verification.
 - d) Earthing should be done in such a manner that the authorized line staff doing the job is protected by earth connections on both sides of the working zone.
 - e) All the three phases should be effectively earthed and short-circuited even though work may be proceeding on one phase only.

5.4 Earthing in Sub-Stations: Earthing is an important aspect of every sub-station. The function of a Earthing system is to ensure the safety of authorized line staff and the public, to minimize hazard from transferred potential, to protect equipment, to provide a discharge path for lightning strikes and to provide a low-resistance path to ground. The earthing installations required at sub-station are as below:

- a. The neutral points of each separate electricity system which has to be earthed at the substation.
- b. Apparatus framework or cladding or other non-current carrying metalwork associated with each system, for example, transformer tanks, power cable sheaths.
- c. Extraneous metalwork not associated with the power systems, for example boundary fences, sheaths of control or communication cables.

For safety, the objective of earth bonding is to ensure that, in normal or abnormal conditions, any voltage appearing on equipment to which there is access should be below a dangerous level. It is not practicable to ensure that metal parts are earthed and remain near true earth potential during the passage of earth fault currents, particularly on high voltage systems with directly earthed neutrals. The objective should, therefore, be to provide effective bonding of low impedance and adequate current-carrying capacity between parts with which anyone may be in simultaneous contact, and to arrange, as far as possible, that large fault currents do not flow between such points. To minimize risk of damage to certain auxiliary plant, the rise of potential of a station earthing installation above the potential of true or remote earth should be as low as practicable, since this potential will be applied across protective insulation of any plant with connections to earth external to the substation, for example, plant with connections to pilot or telephone cables or cable sheaths. For similar reasons, the potential difference between earthed points in the station should also be kept to a minimum. Where surge protection is provided, the connection of the protective devices to earth should be as direct as possible. The discharge of high currents with high-frequency

components requires earth connections of low resistance and reactance, that is, short connections with as few changes of direction as possible.

When the neutral points of two electrically separate electricity systems are connected to a common earth electrode system at a site, there is a coupling of the systems in the event of an earth fault occurring on either system by virtue of the rise of earth potential due to the passage of the fault current through the earth electrode system. Similarly, if non-current carrying metalwork is bonded to the same earth electrode as the neutral point of the supply the metalwork will experience the same rise of earth potential. If complete separation of electrical systems were required, it would be essential that the neutral points of each system and its associated metal work be separately earthed. If such a method were adopted, each earthing system would require insulation from other earthing systems to withstand the maximum rise of earth potential occurring in any system by virtue of lightning currents or power system fault currents. Insulation to this level is rarely practicable.

The choice of using a common earth or separate earths for the system of different voltages at a transforming point affects:

a.	The probability of breakdown occurring in a transformer between the higher and lower voltage sides due to lightning or other surges.
b.	The safety of consumers or their property supplied by any low voltage system distributed from the station against arise of potential of the earthed neutral by a high voltage system earth fault at the station.

The former risk is reduced by use of a common earth system and the latter danger only arises if the resistance of the earth electrode system is not sufficiently low to limit the rise of earth potential to a safe value. There is advantage in using a common earth where the earth electrode resistance, including the parallel resistance of any bonded metalwork, etc to earth is 1 ohm or less, as is usual at power stations, large outdoor substations or substations supplying a network of cables whose sheaths have low impedance to earth.

The substation earth system rise of potential will not be excessive if the resistance of the earth electrode system is small compared to the total earth fault circuit impedance. Systems of higher voltage (66 kV and above) generally have the neutral directly earthed, since the increase in costs of insulation that would be required for the transformer winding would be considerable.

The requirements are, therefore, best considered separately for substations:

- a. where low voltage is confined to auxiliary supplies within the substation;
- b. substations that provide an external low voltage supply; and
- c. power stations.

The use of neutral earthing switchgear in public supply systems is avoided, where possible, since a direct earth is simple, reliable and cheaper than a switched earth. The circumstances in which neutral earthing/switchgear may be necessary are so broad that it is not practicable to form general rules on type and application.

5.4.1 Permissible Current through a Human Body during the Fault: Humans are quite sensitive to AC currents ranging from 50-60 Hz. The effects of the AC current going through a human body depend on the magnitude, duration, and also frequency. The threshold of perception for the human body is about 1mA. Currents between 1-6 am, often called let-go currents, usually do not impair a person from controlling his muscles and releasing the energized object they were holding. Higher currents ranging from 9-25 mA can cause pain and affect the muscle control so that the energized object is hard if not impossible to release. Still higher currents between 25-75 mA can affect breathing and may cause fatality. If current is even higher, it could result in ventricular fibrillation of the heart, which if not treated quickly, can result in death. When currents reach 100 mA and higher, above the ventricular fibrillation level, it can cause burns, heart paralysis and inhibition of breathing.

Chapter-6
CONSTRUCTION AND TRANSPORTATION

6.1 CONSTRUCTION: We should use only good quality and materials as per BIS/ISS specifications, having more than adequate mechanical strength and the desired factor of safety for the supports and conductors as mentioned in the Safety Regulations, for construction of transmission lines and substations.

Using these practices would automatically avoid danger to the public and ensure Safety in the Construction.

Regulation 12 of Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulation 2010: General Safety requirements pertaining to construction, installation, protection, operation and maintenance of electric supply lines and apparatus:

1. All electric supply lines and apparatus shall be of sufficient rating for power, insulation and estimated fault current and of sufficient mechanical strength, for the duty which they may be required to perform under the environmental conditions of installation and shall be constructed, installed, protected, worked and maintained in such a manner as to ensure safety of human being, animals and property.
2. Save as otherwise provided in these regulations, the relevant code of practice of the Bureau of Indian Standards or National Electrical Code, if any, may be followed to carry out the purposes of this regulations and in the event of any inconsistency, the provision of these regulations shall prevail.
3. The material and apparatus used shall conform to the relevant specification of the Bureau of Indian Standards or International Electro-Technical Commission where such specifications have already been laid down.
4. All electrical equipment shall be installed above the Mean Sea level (MSL) as declared by Local Municipal Authorities and where such equipment is to be installed in the basement, consumer shall ensure that the design of the basement should be such that there is no seepage or leakage or logging of water in the basement.

6.2 OVER-HEAD EHV/EHT & HT/LT LINES, UNDERGROUND CABLES & SUB STATIONS/CEA REGULATIONS PROVISION:

1. **Material and strength, Regulation 55 of CEA(measures relating to Safety and Electric Supply) Regulation,2010**
 - i. All conductors of overhead lines other than those specified in regulation 68 shall have a breaking strength of not less than 350kg.
 - ii. Where the voltage does not exceed 250 V and the span is of less than fifteen meters and is drawn through the owners or consumer premises, a conductor having an actual breaking strength of not less than 150 Kg may be used.

2. Joints, Regulation 56 of CEA (measures relating to Safety and Electric Supply) Regulation, 2010.

- i. No conductor of an overhead line shall have more than one joint in a span and joints between conductors of overhead lines shall be mechanically and electrically secure under the conditions of operation.
- ii. The ultimate strength and the electrical conductivity of the joint shall be as per relevant Indian standards.

3. Maximum stresses, factors of safety, Regulation 57 of CEA (measures relating to Safety and Electric Supply) Regulation, 2010

- i. The load and permissible stresses on the structural members, conductors and ground wire of self supporting steel lattice tower for overhead transmission lines shall be in accordance with specifications laid down, from time to time, by the Bureau of Indian Standards.
- ii. Overhead lines not covered in sub-regulation(1) shall have the following minimum factors of safety, namely:
 - i. For metal supports 1.5
 - ii. For mechanically processed concrete supports 2.0
 - iii. For hand, molded concrete supports 2.5
 - iv. For wood supports 3.0

4. Clearance between conductors and trolley wires, Regulation 59 of CEA (measures relating to Safety and Electric Supply) Regulation, 2010.

1. No conductor of an overhead line crossing a tramway or trolley-bus route using trolley wire shall have less than the following clearance above any trolley wire.
 - i. Lines of voltage not exceeding 650 volts 1.2 meters

Provided that where an insulated conductor suspended from a bearer wire crosses over a trolley wire, the minimum clearance for such insulated conductor shall be 0.6 meter.

- ii. Lines of voltage exceeding 650 volts up to and including 11,000 volts 1.8 meters
 - iii. Lines of voltage exceeding 11,000 volts but not exceeding 33,000 Volts 2.5 meters
 - iv. Lines of voltage exceeding 33 kV 3.0 meters
2. In any case of a crossing specified in sub-regulation (1). Whoever lays his line later in time, shall provide the clearance between his own lines and the line which will be crossed in accordance with the provisions of said sub-regulation.

Provided that if the later entrant is the owner of the lower line and is not able to provide adequate clearance. he shall bear the cost for modification of the upper line so as to comply with this sub-regulation.

5. Conductors at different voltages on same supports" Regulation 62 of CEA (measures relating to Safety and Electric Supply) Regulation, 2010.

Where conductors forming parts of systems at different voltage levels are erected on the same support. the owner shall make adequate provision to guard against danger to linemen and others. from the lower voltage system being charged above its normal working voltage. by leakage from or contact with the higher voltage system and the methods of construction and the applicable minimum clearances between the conductors of the two systems shall be as specified in regulation 69 for lines crossing each other.

6. Routes -proximity to aerodromes, Regulation 66 of (EA (measures relating to Safety and Electric Supply) Regulation,2010

Over-headlines shall not be erected in the vicinity of aerodromes unless the Airport Authorities have approved in writing the route of the proposed lines as per relevant Indian Standards.

7. Maximum intervals between supports, Regulation 67 of CEA (measures relating to Safety and Electric Supply) Regulation, 2010.

All conductors shall be attached to supports ,n intervals not exceeding the sale limits based on the ultimate tensile strength of the conductor and the factor of safety specified under regulations 57.

Provided that in the case of over-headlines carrying conductors of voltage not exceeding 650 V when erected in, over, along or across any street, the interval shall not, without the consent in writing of the Electrical Inspector, exceed 65 meters.

8. Condition to apply where telecommunication lines and 'Power lines are carried on same supports, Regulation 68 of CEA (measures relating to Safety and Electric Supply) Regulation, 2010.

- i. Every overhead telecommunication line erected on supports carrying a power line shall consist of conductors each having a breaking strength of not less than 270 kg.
- ii. Every telephone used on a telecommunication line erected on supports carrying a power line shall be suitably guarded against lightning and shall be provided by cut-outs.
- iii. Where a telecommunication line is erected on supports carrying a power line of voltage exceeding 650 V, arrangement shall be made to safeguard any person against injury resulting from contact, leakage or induction between such power and telecommunication lines.

9. Lines crossing or approaching each other and lines crossing street and road, Regulation 69 of CEA (measures relating to Safety and Electric Supply) Regulation, 2010.

Where an over-head line crosses or is in proximity to any telecommunication line. The owner of either the over-head line or the telecommunication line, whoever lays his line later, shall arrange to provide protective devices or guarding arrangement and shall observe the following provisions, namely:

- i. When it is intended to erect a telecommunication line or an over-head line which will cross or be in proximity to an over-head line or a telecommunication line, as the case may be, the person proposing to erect such line shall give one month notice of his intention so to do along with the relevant details of protection and drawings to the owner of the existing line.
- ii. Guarding shall be provided where lines of voltage not exceeding 33 kV cross a road or street.
- iii. Where an over-head line crosses or is in proximity to another overheads line, guarding arrangement shall be provided so as to guard against the possibility of their coming into contact with each other.
- iv. Where an over-head line crosses another over-head line, clearances shall be as under:

(Minimum clearance in metres between lines crossing each other)

S. No.	Nominal System voltage (A.C.)	11-66 (A.C.) kV	110-132 (A.C.) kV	220 (A.C.) kV	400 (A.C.) kV	800 (A.C.) kV
1	Low and medium	2.44	3.05	4.58	5.49	7.94
2	11-66 kV	2.44	3.05	4.58	5.49	7.94
3	110-132 kV	3.05	3.05	4.58	5.49	7.94
4	220 kV	4.58	4.58	4.58	5.49	7.94
5	400 kV	5.49	5.49	4.58	5.49	7.94
6	800 kV	7.94	7.94	4.58	5.49	7.94

Provided that no guarding are required when an extra high voltage line crosses over another extra-high voltage, high voltage, medium or low voltage line or a road or a tram subject to the condition that adequate clearances are provided between the lowest conductor of the extra-high voltage line and the top most conductor of the overhead line crossing underneath the extra-high voltage line and the clearances as stipulated in rule 69 from the topmost surface of the road is maintained.

- v. A person erecting or proposing to erect a line which may cross or be in proximity with an existing line, may normally provide guarding arrangements on his own line or require the owner of the other overhead line to provide guarding arrangements.
- vi. The guarding arrangements shall ordinarily be carried out by the owner of the supports on which it is made and he shall be responsible for its efficient maintenance.
- vii. All work required to be done by or under this rule shall be carried out to the satisfaction of the inspector.

- viii. Where two lines cross, the crossing shall be made as nearly at right angles as the nature of the case admits and as near the support of the lines as practicable and the support of the lower line shall not be erected below the upper line.

Chapter -7
TOOLS & PLANT

7.1 The List of T & P to be maintained:

List of T & P to be maintained by Line man:

S. No.	Material Name	Unit	Quantity
1	GOS Rod(11 kV insulated)	No.	1
2	Rubber Hand Gloves(11 kV Class) Good quality suitable to work on live wire	Pair	1
3	Insulated Cutting Pliers 12"	No.	1
4	Screw Driver (Each) Size 6" Size 12"	No.	1
5	LT line Tester	No.	1
6	Helmet	No.	1
7	Safety Belt	No.	1
8	Adjustable screw spanner	No.	1
9	Rain Coat (light Weight)	No.	1
10	Chargeable Hand Torch	No.	1
11	Goggles	No.	1

List of T & P to be maintained by J.E. and A.E/A.E.E:

Sr. No	Material Name	Unit	Quantity
1	Telescopic Earthing Rod	Sets / Nos.	2 (6 Nos.)
2	Fiber Ladder	Nos.	2
3	Chargeable Hand Torch	No.	1
4	Rubber Hand Gloves (11 kV Class)	No.	1
5	11 kV Line Tester	Nos.	4
6	Helmet	No.	1
7	Rain Coat (light Weight)	No.	1
8	Rubber Mat Size 2' X 3'	Nos.	2

7.2 INSPECTION OF SAFETY EQUIPMENT

All safety equipment shall be thoroughly inspected:

1. Monthly, by the T&P holder.
2. Quarterly, by the Assistant Engineer/Assistant Executive Engineer,
3. Once in six months, by the ASE/Sr. Xen Officer for its being in good condition.

CHAPTEB-8

FIRST- AID

8.1 Treatment for Electric Shock Asphyxiation (Suffocation) and Drowning

In most of the cases of electric shock and collapse, it is the lungs and the diaphragm (the thin sheet of muscles which lies below the lungs) that have stopped working and there is a very good chance of revival by applying artificial respiration quickly.

In case of severe shock, respiration is seldom established less than one hour while three to four hours or more might be found necessary to restore normal breathing. It is therefore essential that in all cases of electric shock where the condition of the patient is doubtful or the patient is unconscious or not breathing, artificial resuscitation should be continued until the patient breathes normally or until the doctor has pronounced life extinct.

8.2 Resuscitation Drill: Every authorized line staff shall qualify himself by practical study and drill in the treatment for electrical shock according to the instructions contained in this Chapter.

8.3 Removal of Contract: If the authorized line staff is still in contact with the apparatus that has given the shock, switch off the electric circuit at once if there is a switch, fuse or circuit breaker close at hand, if not, lose no time from proceeding to remove the body from contact with the live conductor.

Do not touch the victim's body with bare-hands, but if rubber gloves are not in hands pull the victim off the line conductor by his coat, shirt etc., if they are not wet or fold your coat or some dry article such as news paper to three or more folds/thickness and using this as a pad, take hold of the body and pull it away from the circuit. An operating rod or a broom handle may be used to raise the body or to detach the wires from it. Layers of thick news paper or bundle of dry sacking and remove the victim away from the live apparatus. Dried wooden sticks or rods can be used without any risk or shock.

If the victim is at height, efforts must be made to prevent him from falling or to make him fall safe

If the casualty is unconscious but is breathing loosen the clothing around neck chest and waist and place the casualty in the recovery position.

Extinguish any sparks if the patient's clothes smoldering. Send for bringing a doctor while simultaneously keeping watch on the victim on his breathing and heart beat. If apparently not breathing proceeds as per detail there here under:

In case of severe bleeding especially wrist, hand or fingers. It must be considered and should be given serious attention.

- i. Make the victim to lie down and rest.
- ii. If possible raise the injured part above the level of the body / heart and apply pressure to the wound.
- iii. Call for medical Assistance.

8.4 Immediate Action to Recover the Patient:

When a man has received severe electric shock or been subjected to poisonous gases, or has been removed from the water in a drowning condition, his breathing is usually stopped. In accidents of this kind, speed may save the injured man's life; hence do not waste a second. Send for a doctor at once but do not neglect the patient in doing so.

The first thing to do is to get the injured man to a suitable place where you can work on him. This may necessitate lowering from a pole or raising him from a manhole. This work usually involves considerable danger to the rescuer, because a manhole may be full of poisonous gases, or the injured man may be in contact with the dangerous circuit on the pole. You must, therefore, work very carefully.

Avoid so placing the patient as to bring pressure on the burns he has sustained, if any. Do not expose the patient to cold. Stimulants should not be administered unless recommended by a doctor. Cold water may be given in small quantities in cases of electric fire or asphyxiation cases and smelling salts may also be administered in moderation.

Continue artificial respiration without interruption until breathing is restored. Cases of success are on record after resorting for artificial respiration for more than 3 hours. Ordinary tests for death are inconclusive in cases of electric shocks and Doctor's pointed attention must be drawn to this when necessary.

Resuscitation should be carried on at the nearest possible place where the patient received his injuries. He should not be removed from this place until he is found breathing normally and then also should be moved only in lying position. Should it be necessary due to extreme weather conditions, etc. to move the patient before the victim starts breathing normally, he should be kept in a prone position and placed on the hard surface (door or shutter) or on the floor of a conveyance, resuscitation being carried on during the time that he is being removed.

A brief return of spontaneous respiration is not a certain indication for terminating the treatment. Not infrequently, the patient, after a temporary recovery of respiration stops breathing again. The patient must be watched and if normal breathing stops, artificial respiration should be resumed at once.

8.5 Upon Recovery: When the victim revives, he should be kept lying down and not allowed to get up or be raised under any circumstances, unless on the advice of a doctor. If the Doctor has not arrived by the time the victim has revived, he should be given some stimulant, or a drink of hot ginger tea or coffee. The victim should then have any other injuries attended to and be kept warm, being placed in the most comfortable position.

8.6 First Care of Burns: Burns, if serious, should be treated with a proper dressing. A raw or blistered surface should be protected from the air. If clothing sticks, do not peel it off but cut around it. The adherent cloth or a dressing of cotton or other soft material applied to burnt surface should be saturated with picric acid (0.5%). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of Hour and water, or it may be protected with Vaseline, carron oil, olive oil, castor oil or machine oil. If clean, cover the

dressing with cotton gauze, linen, clean waste, handkerchief. or other soft cloth, held tightly in place by bandage. The same coverings should be tightly bandaged over a dry, charred burn, but without wetting the burnt region or by applying oil to it. Do not open blister.

8.7 Treatment for electric Burn:

If, as result of electric shock the victim is suffering from burns, the following treatment should be given without hindrance to artificial respiration:

- i. Remove clothing locally to enable the burn to be treated but do not break blisters.
- ii. Saturate burns with warm solution of one dessert spoonful of bicarbonate of soda to a pint of warm water or a teaspoonful of salt to a pint of warm water.
- iii. Cover with lint soaked in a similar solution and bandage (lightly if blisters have formed).
- iv. If the above solutions are not available, cover with sterile dressing.
- v. Warm, weak sweet tea may be given when the patient is able to swallow.

8.7 Artificial Respiration

8.7.1 Nelson's Arm lift back pressure method: Place the victim prone face down with his arms folded with the palms one over the other and the head resting on his cheek over the palm. Kneel on one or both knees near the victim's hand. Place your hands in the victim's back beyond the line of the armpits, with your fingers spread outwards thumbs just touching each others.

Gently rock forward keeping the arms straight until they are nearly vertical and thus steadily pressing the victim's back to force the air out of the victim's lung.

Synchronizing the above movement rock backwards, slide your hands downwards along the victim's arms and grasp his upper arm just above the elbows as shown.

As you rock back, gently raise and pull the victim's arms towards you until you feel tension in his shoulders. To complete the cycle, lower the victim's arms and move your hands up to initial position. This method should not be used if there are injuries on the chest and belly of the victims.

8.7.2 Schafer's method: Lay the victim on his belly, with one arm extended directly forward and the other arm bent at the elbow and with the face turned sideward and resting on the hand or fore arm. Kneel astride the victim, so that his thighs are between your knees and with your fingers and thumbs positioned.

With the arms held straight swing forward slowly so that the weight of your body is gradually brought to bear upon the ribs of the victim to force the air out of victim's lungs.

Now swing backward immediately removing all the pressure from the victim's body.

After two seconds, swing forward again and repeat the cycle for twelve to fifteen times a minute.

However, this method cannot be adopted if there are injuries on the chest and belly of the victim.

8.7.3 Direct Artificial Respiration: Direct artificial respiration is the method whereby a authorized line staff ventilates the lungs of an unconscious non-breathing victim by blowing his own breath directly in to the mouth or nose of the victim.

Expired air is not dead air. It has been proved more than adequate for artificial respiration. The atmosphere contains 21 % oxygen while expired air contains 14-18 % oxygen.

It has been clearly established that direct artificial respiration is superiors to indirect artificial respiration (manual method), in all age groups and in all situations.

Indirect manual methods of artificial respiration cannot be applied in many situations when emergency resuscitation is urgently required.

For example, in case of severe chest and spinal injuries, indirect manual methods cannot be used. Furthermore, a victim may be partially buried in a cave or trapped behind a steering wheel or located in cramped quarters as would be the case in small craft aero planes and other places.

In all these instances, the victim's survival will depend upon direct artificial respiration.

The procedure for Direct Artificial Respiration (mouth to mouth method) is as follow:

- i. Place the victim on back immediately.
- ii. Clear throat of water, mucus, coins, or food.
- iii. Tilt head back as far as possible.
- iv. Lift jaw up to keep tongue out of air passage.
- v. Pinch nostrils to prevent air leakage when you blow.
- vi. Blow until you see the chest rise.
- vii. Listen for snoring and gurgling signs of throat obstruction.
- viii. Repeat blowing 10-20 times a minute.

In case of infants and small children tilt the head fully back, surround the mouth and nose completely with your mouth. Blow with only enough force to produce a visible rise in the victim's chest and no more. Repeat every 3 seconds. Continue direct artificial respiration until victim breathes for himself or until expert help is obtained. The method is fully described hereunder:

Step 1: Lay the victim flat on his / her back and place a roll of clothing under the shoulders to ensure that his head is thrown well back. Tilt the victim's head back so that the chin points straight upward.

Step 2: Grasp the victim's jaw, and raise it upward until the lower teeth are higher than the upper teeth; or place finger on both sides of the jaw, near the ear lobes, and pull upward. Maintain jaw position throughout artificial respiration to prevent the tongue from blocking the air Passage.

Step 3: Take a deep breath and place your mouth over the victim's mouth. Making airtight contact. Pinch the victim's nose shut with thumb and forefinger. If you dislike direct contact, place a porous cloth between you and the victim's mouth. For an infant, place your mouth over his/her mouth and nose.

Step 4: Blow into the victim's mouth (gently in the case of an infant) until his chest rises. Remove your mouth, & release the hold on his nose, to let him exhale, turning your head to hear the out-rush of air. The first eight to ten breaths should be as rapid as the victim responds. Thereafter the rate should be slowed to about 12 times a minute (20 times for an infant).

8.7.4 Mouth to nose method:

If the victim's mouth will not open or has a blockage which cannot be cleared, use the fingers of one hand to keep the victim's lips firmly shut and seal your lips round the victim's nostrils and breathe in to him check to see if the victim's chest is rising and falling.

Note:

1. If air cannot be blown in, check the position of the victim's head and jaw and recheck the mouth for obstructions, then try again more forcefully. If the chest still does not rise, turn the victim's face down and strike his back sharply to dislodge obstructions.
2. Sometimes air enters the victim's stomach, as evidenced by a swelling stomach. Expel air by gently pressing the stomach during the exhalation period.

In any case where external cardiac compression and artificial respiration are being administered Pressure - Cycling mechanical resuscitators shall not be used in lieu of mouth-to-mouth or other approved artificial respiration, because they may not be effective in adequately ventilating the lungs with air (oxygen).

Medical research has shown that properly administered mouth to mouth resuscitation is at least as effective as mechanical resuscitator: also. MMR can be performed effectively without the use of airways of any kind. The time delay in waiting for a mechanical resuscitator or an airway to be made available and placed in operation could materially reduce or preclude the victim's chance of recovery.

Care for the unconscious:

- i. Oxygen is the element most vital for survival. Permanent brain damage or death may result within a few minutes from lack of air or oxygen. Therefore a victim's breathing requirements must receive your first attention.
- ii. The cause of unconsciousness may be obvious, as in the case of drowning, electric shock, smoke or gas inhalation, strangulation, severe injuries, etc.
- iii. The cause of unconsciousness may be obscure, as in the case of poisoning, overdose of drugs, alcoholism, heart disease, brain disease, diabetes, uremia, epilepsy etc.
- iv. An unconscious authorized line staff may be breathing or not breathing.
- v. In either case an open air passage to the lungs must be maintained. The human tongue is as large as a quarter pound beefsteak. The muscles of the tongue relax with loss of consciousness. In certain positions the tongue falls back, obstructing the throat and cutting off the air passage.

8.8 The unconscious authorized line staff who is breathing: Many accident victims, especially those sustaining head injuries (common in home and traffic accidents), suffer temporary shock and loss of consciousness. This may lead to death by suffocation.

Accidental death may be avoided in such cases by first taking a simple precaution:

- i. Place the victim on his side or abdomen with his head turned to one side and tilted back.
- ii. In this position there is less danger of obstruction by the tongue or aspiration of vomits into the lungs.

8.9 The unconscious authorized line staff who is not breathing:

In such cases the unconscious victim requires immediate artificial respiration. Direct artificial respiration is the most positive and efficient means of ventilating his lungs.

The indirect or manual chest compression methods of artificial respiration (Holger Neilsen, Schafer., etc.) depend on negative pressure, and are unsatisfactory unless provision has been made to establish and maintain an open air passage to the lungs.

8.10 The Unconscious authorized line staff whose breathing is very slow or shallow:

The victim may be assisted by direct artificial respiration, timing the air inflation with the patient's breathing efforts.

8.11 SPECIAL CARE SITUATIONS:

8.11.1 Drowning:

- i. Direct artificial respiration must be started if victim's head can be kept above the water.
- ii. Do not waste valuable time waiting to bring the victim ashore or by attempting to drain the stomach or throat beforehand. This may be done after artificial respiration has been started.
- iii. If the stomach is distended, lower and turn the victim's head to the side and then apply moderate pressure with the palm of the hand over the distended stomach. Any air or water in the stomach will be then belched up.

8.11.2 Inhalation of foreign bodies: If the victim is a child, turn him over your knees in the "spanking position", with his head lower than his hips; slap him between shoulder blades in all attempt to dislodge the foreign body by causing him to cough it out. If the object is not dislodged and the child is in distress, quickly clean the throat with the fingers and begin direct artificial respiration.

8.11.3 Infant and child victims: The technique of direct artificial respiration is essentially the same in cases involving children and adults. However, in the case of infants and children:

- i. Only a small volume of air is required to inflate the lungs. Over-inflation may produce damage. Short puffs of air are all that are required, sufficient to produce a noticeable rise in the infant's chest with each inflation.
- ii. The inflation rate should be at least every 3 seconds, twenty times per minute.
- iii. An over-distended stomach in infants interferes with ventilation as well as normal heart action. This may be reduced by applying pressure over the infant's abdomen, care being taken to avoid aspiration of the fluid brought up in this manner by turning the head to one side.

8.12 FIRSTAID BOX:

- i. A First Aid Box is an essential medical unit in any habitual premises. It ensures tiding over the crisis by avoiding last minute hunts. It should be kept at accessible place, and bare essentials stored in it. Each item must be replaced, as soon as it gets used up.
- ii. The essential items to be preserved in the First Aid Box are given below:

8.12.1 Contents of First Aid Box

S. No.	Contents	Quantity
1.	Wound dressing (sterilized)	6Nos.
2.	Burn dressing (sterilized) Large	3 Nos.
3.	Adhesive plastering ((for fastening dressing). 2 cm x 1 mtrs.)	1 No.
4.	Washable Bandage	6 Nos.
5.	Triangular Bandage (for fractures) - large	1 No
6.	Safety pins (for fastening bandages)	1 Bunch
7.	Scissors (of fastening bandages)	1 Pair
8.	Scissors (of stainless steel) 8 cm plank	1 Pair
9.	Absorbent cotton wool for cleaning wound)	100 Grams
10.	i. Potassium Permanganate B.P. ii. Tincture iodine B.P. (for all wound) iii. Dettol or Savlon iv. Hydrogen peroxide (Antiseptic and bleeding stopper)	1 Bottle 1 Bottle 1 Bottle 1 Bottle
11.	Snake bite lancet	1No.
12.	Burn Ointment (for burns. cuts & insect bites) e.g. Burnol or Badiohnat	1 Tube
13.	Tourniquet (for stopping bleeding)	1 Set
14.	i. Soda-bi-carb. BP For acid burns) ii. vinegar (for Alkali burns]	1 Bottle 1 Bottle
15.	Eye Drop sterilized eye pads (separate by seal)	1 Bottle 6 Nos.
16.	Anti Allergy tablet (avil or pyrigesic)	50 Nos.
17.	Analgesic tablet (crocin or pyrigesic)	100 Nos.
18.	i. Spirit of Sal volatile ii. smelling salts	1 Bottle 100 Grams
19.	First Aid Leaflet	1 Copy

CHAPTER -9

SAFETY BINDINGS ON CONTRACTORS

Regulation 7 of Central Electricity Authority (Safety requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines), Regulations 2011

9.1 Safety Provisions relating to contractor:

1. The Owner shall incorporate the safety provisions in the contract document which are required to be compiled by the contractor's employees during execution of the contract to facilitate safe working during execution of the work.
2. The Contractor shall observe the safety requirements as laid down in the contract and in case of sub-contract. it shall be responsibility of main contractor that all the safety requirements are followed by the employees and staff of the sub-contractor.
3. The Contractor employing two hundred employees or more, including contract workers. shall have a safety coordinator in order to ensure the implementation of safety requirements 01 the contract and a contractor with lesser number of employees, including contract workers, shall nominate one of his employees to act as safety coordinator who shall liaise with the safety officer on matters relating to safety and his name shall he displayed on the notice board at a prominent place at the work site.
4. The Contractor shall be responsible for non-compliance of the safety measures, implication, injuries, fatalities and compensation arising out of such situations or incidents.
5. In case of any accident, the contractor shall immediately submit a statement of the same to the owner and the safety officer containing the details of the accident, any injury or causalities, extent of property damage and remedial action taken to prevent recurrence and in addition, the contractor shall submit a monthly statement of the accidents to the Owner at the end of each month.

9.2 Safety aspects during Civil Work.

1. In exercise of the Power Conferred by clause (el) of sub-section 2 of section 176 of I.E. Act, 2003. An Electricity plan prepared under the provision sub-section 4 of section 3 of the Act shall be published in the Govt. gazette and at least two daily vernacular Language Newspapers.
2. The plan layout of the Sub-Station for method of Construction & Route of line must be got approved from Electrical inspector.
3. After approval of Electrical plan layout of switchyard, a civil foundation plan layout is to he prepared & got approved from competent authority then only the Civil Work is taken in hand.
4. Land Leveling:
 - i. The leveling of the land is done to make available a plain land for switchyard development.
 - ii. There shall not be water logging during the rain season/rainy water must drain away.
 - iii. The level of the cable trench should be maintained so that water will be drained away immediately.

5. Construction quality has long term effect on safety; hence ensure excellent quality of work during every stage of the project construction.
6. The Record of the Civil Quality test taken at all stages of construction must be documented / preserved.
7. Seasonal & Trained young workers must be engaged for civil work, preferably with Knowledge of the site.
8. Workers protective equipments like helmet, safety belt, boots hand lamps etc. must invariably be used while working in the yard.
9. Child Labor -It is criminal to employ child labor.

9.3 Unsafe conditions in Civil work.

S. No.	Unsafe Conditions	Prevention
1.	Risk of fall of worker during installation due to i. Open pit of Civil foundation. ii. Open Cable Trench. iii. Unguarded opening from First / Second floor in slabs.	i. The foundation pit must be barricaded by the Rope & danger signs. ii. Put Cable Trench covers. iii. Put barricade around the opening and place danger / warning signs as necessary.
2.	Mistake in Civil Layout i. Insufficient clearance. ii. Insufficient clearances for Movement.	The plan of the layout must be got approved from competent authority and take necessary corrective steps during construction in consultation with competent authority.
3.	Uneven foundation i. Inclined superstructure. ii. Inclined equipment.	The level of the foundation must be maintained & level to be taken by dumpy level must be taken before casting the foundation.
4.	Accident during transportation / material handling i. Road not Ready. ii. Inadequate strength width / curvature.	Good quality internal Road must be ready with adequate width & curvature before actual transportation of material is started.
5.	Uneven Roof level	Arrangement must be made to drain out the rainy water so that the water leakage eliminated.
6.	Snakes in the cable trench	Use poisonous gas sprays at regular interval.

7.	Inadequate water arrangement & its storage	Before start of work the water arrangement must be made for i. Drinking ii. Civil work For the initial stage of civil work, Temporary water arrangement must be done for drinking & other works.
8.	Open water pipe line.	The pipe line must be laid under ground.
9.	Roof leakage During rains and water spray through window.	Water proofing of Roof-top parapet wall above window should be done.

9.4 Unsafe Act.

S. No.	Unsafe Act.	Prevention
1.	Digging in the switch yard without know sledge of underground wiring/cable/ water pipe line.	Work must be taken under the supervision of authorized staff with adequate knowledge of the site.
2.	Putting lot of debris & garbage in the yard.	Put the yard clean, keep out unwanted equipment / material outside the yard as soon as the work is over.
3.	Large heap of soil from excavation.	Put danger signs and barrier fencing round the uncompleted work.
4.	Running around in the yard with Rush of work.	Plan the work & be calm on the worksite.
5.	Survey in the substation by Iron Ranging Rod.	Use Bamboo in Place of Iron Rod.

Identification of the name of equipment & Demarcation of work hazardous / dangerous Area in view of Safety.

(Measures relating to safety and electric supply)

i. Regulation 18 of Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulation 2010: Danger notices:-

The owner of every installation of voltage exceeding 250 V shall permanently in a conspicuous position a danger notice in Hindi or English and the local language of the District, with a sign of skull & bones of a design as per IS-2551:-

- a. Every motor, generator, transformer and other electrical plant and equipment together with apparatus used for controlling or regulating the same.

- b. All supports of overhead lines of voltage exceeding 650 V which can be easily climbed upon without the aid ladder or special appliances.
- c. Luminous tube sign requiring supply, X-ray and similar high frequency installations of voltage exceeding 650 V but not exceeding 33 kV.

Provided that where it is not possible to affix such notices on any generator, motor, transformer, or other apparatus, they shall be affixed as near as possible there to or the word “danger” and the voltage of the apparatus concerned shall be permanently painted on it:

Provided further that where the generator, motor, transformer or other apparatus is within an enclosure, one notice affixed to the said enclosure shall be sufficient for the purposes of this regulation.

Explanation – For the purpose of clause (b) rails, tubular poles, wooden supports, reinforced cement concrete poles without steps, I-sections and channels, shall be deemed as supports which cannot be easily climbed upon.

ii. Regulation 24 of Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulation 2010: Distinction of different circuits:-

The owner of every generating station, Sub-station, junction-box or pillar in which there are many circuits or apparatus, whether intended for operation at different voltages or at the same voltage, shall ensure by means of indication of a permanent nature, that the respective circuits are readily distinguishable from one another.

iii. Regulation 25 Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulation 2010: Distinction of the installation having more than one feed:-

The owner of every installation, including Sub-Station, double pole structure, four pole structure or any other structure having more than one feed, shall ensure by means of indication of a permanent nature, that the installation is readily distinguishable from other installations.

iv. Regulation 73 Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulation 2010: Safety and Protective devices:

- Every overhead line which is not being suspended from dead bearer wire, not being covered with insulating material and not being a trolley wire, is erected over any part of a street or other public place or in any factory or mine or on any consumer's premises shall be protected with earth guarding for rendering the line harmless in case it breaks.
- **Anti-climbing devices:**

The owner of every HV/EHV O/H line shall make adequate arrangements to the satisfaction of inspector to prevent unauthorized line staff/ unauthorized persons from ascending any pole of such line, which can be easily climbed upon without the help of a ladder or special appliances.

9.5 Identification:

i. It will be easy to identify when the Location line when:

- The Each Tower of the line with Location Number.
- Each equipment is marked with code Number & bay Name.
- For easy identification Each Room is marked with Room name plate in the building

ii. Affix permanently, with Bold Letters, on visible Position-.

1. Identification labels on the line:

- Location Number Plate.
- Phase plate (Indication R-Y-B Phase).
- Circuit Name plate in case of Double Circuit line.
- Anti climbing device with Danger Notice.

Indicating plate cum Notice Board must be fixed on the Tower Line which will help in avoiding accident and lead to safety.

2. Sub-Station switch yard: Each bay in the switch yard shall be painted permanently with bay name

Each equipment/control box shall be painted with their code name/ SCADA nomenclature.

- Power Transformer.
- Auxiliary Transformer.
- Breaker.
- Isolator with Earth Blade and Without Earth Blade
 - a. Auxiliary.
 - b. Mainbus-1.
 - c. Main bus-II.
- C.T/PT/LA/CC/CVT with colour code (R,Y,B).
- Control Box.
 1. Isolator Control Box.
 2. CT/PT/CVT Control Box.

3. Building:-

- Control Room -Name of bay on control & relay panel. All Control & Relay.
- Panel must be painted with respective Name of bay as per SCADA nomenclature.
- Battery Room.
- Battery Charger Room.
- PLCC Room/Carrier Room/Broad Band.
- AC supply Room (Name of the feeders).

- Air conditioning plant Room.
- Compressor Room.
- Office of the Incharge.
- Store Room.
- Laboratory.

By painting the Name on the equipment/Room

1. It will be easy for identification of equipment on which work has to be carried out.
2. Demarcation of working Area is easy.
3. Identification of work spot from long distance is easily visible.

9.6 Demarcation: Before any work is to be started / carried out in or adjacent to a charged (live) area the work area to be clearly demarcated.

1. **WARNING BOARDS:** Warning boards shall be placed by the authorized line staff-in-char., on all switchgear before men are permitted to work and should only be removed by the authorized line staff who has placed them. It is desirable that the authorized line staff issuing the permit shall place one warning board on the switch energizing the mains for each permit issued so that he can be sure that all the permits-to-work are returned when he has to charge the mains.
2. **VISITORS AND UNAUTHORIZED PERSON:** Visitors and unauthorized person shall not be allowed to proceed to the Vicinity of live mains and apparatus, unless accompanied by an authorized line staff that will be responsible to ensure that his instructions regarding safety are strictly complied with.
3. **WARNING THE PUBLIC:** When, either accidentally or otherwise, live mains and apparatus pose a danger to authorized line staff in a public place, a authorized line staff shall be directed to stand at such locations for authorized line staff warning the public until the danger has been removed/cleared.

Equipment on which work is to be carried out must be readily identifiable. Where necessary a means of identification must be fixed to it, which shall remain effective throughout the course of the work.

4. **DANGERS:** The main **Danger** to authorized line staff working in substation.
 - The possibility of mistaking **Equipment** on which it is unsafe to work.
 - Inadvertently infringing **Safety Clearances**.
 - Other induced voltage on the **Equipment from adjacent/nearby live equipment/line**.
 - Failure to make proper use of authorized line staff protective equipments.

- i. Where work is to be carried out near to **Equipment** which may be **Live**, then the limits of the work area must be defined as per the **Safety Clearance**.
- ii. Boundary mark must be clearly identifiable and easy to see. They must only be fixed or removed only by the maintenance authorized line staff under the **Supervision** of the **Maintenance Engineer / Shift Engineer**.

9.7 Boundary marking should

- Be independently supported.
 - Not be attached to any structure supporting any Equipment.
 - Not carry any notice.
- i. The boundary of the work area must be identified using plastic tape or nylon rope of about 8/10 mm diameter.
 - ii. Where the work is separated from adjoining areas by fixed screens, the work must be identified by green cones placed within the safe area and visible from the outside at each point of access. The fixed screens must remain in position during the course of the work.

CHAPTER-10
DO'S AND DO NOT'S

10.1 General Safety Measures that should be followed while performing any operation:-

S. No.	Do's	Do Not's
1.	Before replacing a lamp or handling a fan, make sure that the supply is switched off.	Do not connected single pole switch or fuse in a neutral circuit, but always connect in the live or phase wire
2.	Place Safety Tagging or other warning boards on main switch before commencing work	Do not close any switch, unless you are familiar with the circuit which it controls and know the reason for its being open
3.	Before working on any circuit or apparatus, make sure that the controlling switches are open and locked.	Do not touch or tamper with any electrical gear or conductor, unless you have made sure that it is dead and earthed. High voltage apparatus may give leakage shock or flash over even without touching
4.	Always treat circuit as live until you have proved them to be dead, the insulation of the conductor may be defective.	Do not work on live circuit without the orders of the authorized Engineer/person. Make certain that all safety precautions have been taken
5.	Cultivate the habit or turning your face away whenever the flash or an arc may occur	Do not disconnect earthing connection or render it ineffective of the safety gadgets installed on mains and apparatus
6.	Guard against arcs as well as high voltage; remember that burns from arc are very severe	Do not tamper with the meter board and cut-outs, unless you are authorized to do so
7.	See that all the splices and connections are securely made	Do not expose your eyes to an electrical arc. Painful injury may result even with short exposure
8.	Use extreme care when breaking an inductive circuit as dangerously high voltage is likely to result	Do not close or open a switch slowly or hesitatingly. Do it quickly and positively
9.	Thoroughly discharge to earth all cables before working on cores	Do not place any part of your body in circuit either to ground or across the terminal when making a connection or doing operation

10.	Test rubber gloves periodically	Do not touch an electrical circuit when your hands are wet, bleeding from a cut or have an abrasion
11.	Place rubber mats in front of electrical switchboard	Do not work on energized circuit without taking extra precautions, such as the use of rubber gloves. Do not use metal case flash light around apparatus which is energized
12.	Preach and practice safety at all the time. Good work can be spoiled by an accident	Do not wear loose clothing, metal, watch straps, bangles or finger rings while working on appliances. Do not hand clothes and such other things on electric fittings. Do not touch the circuit with bare fingers or hand or other makeshift devices to determine whether or not it is live
13.	Work deliberately and carefully Haste causes many accidents. Be sure of what you are doing	Do not work on pole or any elevated position if there is a live partion it, without the safety belt and rubber gloves and unless the authorized line staff stands on the ground nearby to direct operation and give warning
14.	Always obey the safety instructions given by the staff in-charge	Do not use a ladder without a lashing rope, otherwise the ladder should be held firmly by another authorized time staff. Do not remove Safety Tags or other signs or interface with safety barriers or go beyond them
15.	Always report immediately to the authorized line staff in-charge or to any other proper authority of any dangerous condition or a practice, which you may observe	Do not bring naked light near battery Smoking in the battery room is prohbited. Do not allow visitors and un authorized personnal to touch or handle electrical apparatus or come within the danger zone of high voltage apparatus
16.	Ensure that all portable appliances are provided with 3 pin plug and socket connections. Also the metal work of the apparatus is effectively earthed	Do not use a lamp in a metal holder fixed to the end of a loose flexible wire as a portable hand lamp. Do not disconnect a plug by pulling the flexible cable or when the switch is on

CHAPTER-11

SAFETY AND DISASTER MANAGEMENT

11.1 General: Himachal Pradesh is prone to many natural hazards such as Earthquakes. Landslides, flash floods, snowstorms and avalanches etc.

The state is also evident to the hazards which are manmade such as forest fires, accident road, Industrial and hazardous chemicals. Earthquakes, however is the most prominent danger in the state, as 80 earthquakes have been experienced in the state. As per the BIS seismic zoning map five districts of the State, namely Chamba (53.2%) Hamirpur (90.9%), Kangra (98.6%), Kullu (53.1%), Mandi (97.4%) have 53 to 98.6 percent of their area liable to the severest design intensity of MSK IX or more, the remaining area of these districts being liable to the next severe intensity VIII. Two districts, Bilaspur (25.3%) and Una (37.0%) also have substantial area in MSK IX and rest in MSK VIII. The remaining districts also are liable to intensity VIII.

Landslides are the other common disaster in the state which causes the immense loss of life and property. The Safety precautions required to be followed in the disasters are as follows:

11.2 EARTHQUAKE SAFETY PROCEDURES: It is not possible to prevent earthquakes or change the Likelihood of an earthquake occurring. However, we can greatly increase our chances of safety, and survival, by being aware and prepared. Since knowledge and preparation are keys to our survival during and after an earthquake, we should take steps to become informed.

11.3 Dangers Associated with Earthquakes: The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Most casualties result from falling objects and debris or collapsing structures. Injuries are commonly caused by:

- a. Partial building collapse, falling masonry, collapsing walls, falling ceiling plaster, etc.
- b. Flying glass from broken windows.
- c. Overturned bookcases, cabinets, fixtures, furniture, office machines and appliances.
- d. Fires, broken gas lines. These dangers may be aggravated by lack of water due to broken mains.
- e. Fallen power lines.
- f. Inappropriate actions resulting from panic.

11.4 Earthquake Safety Guidelines

- i. Remain Calm. Sound usually precedes earthquake motion by a split second. If you have developed the correct earthquake responses in your mind before a quake, this split second is enough time to activate your automatic reactions. If you stay calm, you will be better able to assess your situation. The rolling and roaring may terrify you, but unless something falls on you, the sensations probably won't hurt you. Try talking yourself through the violent motion phase. This will release stress and others may take courage and follow your reasoned restraint. Think through the consequences of any action you plan to take.

- ii. If you are indoors, stay there. If you are in danger:
 - Get under a study table, desk or bed.
 - Brace yourself in an inside corner away from windows. Move to an inner wall or corridor. (A door frame or the structural frame or inner core of the building are its strongest points and least likely to collapse. They will also break the impact of any falling objects).
 - In an apartment building the safest place is by the central reinforced core of the building, which is usually located by the elevator well.
 - Choose shelter which will provide an airspace if it collapses. If your furniture shelter moves, stay under it and follow it around the apartment.
 - Watch for falling objects – plaster, bricks, light fixtures, pots and pails, etc
 - Stay away from tall shelves, china cabinets and other furniture, which might slide or topple over.
 - Stay away from windows, sliding glass doors, mirrors.
 - Grab anything handy (blanket, pillow, tablecloth, newspapers, box, etc.) to shield your head, and face from falling debris and splintering glass.
 - Don't be alarmed if the fire alarm or sprinklers go off.
- iii. Do Not Rush Outside. Stay on the same floor that you are on. Stairways may be broken and exits jammed with people. Do not use elevators as the power for elevators may go out and leave you trapped. The greatest danger from falling debris is just outside door-ways and close to outer walls. If for safety reasons you must leave the building, choose your exits as carefully as possible.
- iv. If you are outside, stay there. Move away from the building, garage, walls, power poles and lampposts. Electric power lines are a serious hazard, stay away from fallen lines. If possible, proceed cautiously to an open area.
- v. If you are in a moving car, stop. Stop as quickly as safety permits in the best available space. Stay in your car. Don't stop where buildings can topple down on top of you. A car is an excellent shock absorber and will shake a lot on its springs during an earthquake, but it's a fairly safe shelter from which to assess your situation.
- vi. Avoid Fallen Power Lines. The possibility of encountering fallen live wires is great during and after an earthquake. If you are on foot, make a wide path around the wires. If you are in the car and live wires have fallen across the car, remain where you are. Your car is usually well insulated and will protect you from electric shock. Never assume that downed power lines are dead.

11.5 After an Earthquake:

11.5.1 Within the First Several Minutes:

- i. Remain Calm. Don't Panic. Try to calm and reassure others. Stop and taken time to think.
- ii. Wait until all motion has stopped. Do not run down stairs or outdoors. Be prepared for additional shockwaves.
- iii. Do not light matches, cigarettes or turn on electrical switches. Flashlights are one of the best light sources after a damaging earthquake. Proceed with extreme caution.
- iv. Protect hands and feet from broken glass or debris. Keep head and face protected (hard-hat, blanket, tablecloth, etc.).
- v. Make a quick check for injuries or trapped people. Provide emergency first aid if needed.
- vi. Do not try to move seriously injured persons unless they are in immediate danger from further injury
- vii. Turn off all appliances and office machines. Extinguish all open flames. Check power lines and cords. If problems exist in electrical lines or gas lines the mains should be shut off.
- viii. It may be necessary to draw a moderate amount of cold water in bathtubs and sinks and other containers, in case service should be disrupted.

11.5.2 During the Next Several Hours:

- i. Do not operate electrical switches, appliances or open-flame equipment if gas leaks are suspected. Sparks or flames can ignite gas from broken lines causing an explosion.
- ii. Tend further to injured or trapped persons. Try to get help if necessary. If a person is trapped and you can free him without injury [0 yourself, remove debris piece-by piece starting with the top of the pile.
- iii. Be prepared for aftershocks· they are weaker than the main shock but can cause additional damage and psychological trauma. Watch out for other possible dangers, which may follow an earthquake, such as fire, flood, and landslide.
- iv. Turn on a battery radio to receive disaster instructions. Use telephones only to report extreme emergency situations.
- v. Inspect your work area carefully for structural damage. Carefully open exit doors they sometimes jam. The initial quake may damage the structure and an aftershock could knock down weakened walls. Use extreme caution when moving around in damaged areas they may collapse without warning. Check to see that sewage lines are intact before flushing toilets.
- vi. One should not try to get home until government authorities say it is safe, which will be when the worst fires are under control and the streets have been cleared. This may happen quickly or it may take longer (perhaps 72 hours or more). You should advise your family that in the event of a major earthquake you may be re trained at work. When possible notify your family about your well being.
- vii. Don't go outside Sightseeing. Keep streets clear for passage of emergency vehicles. Your presence might hamper rescue and other emergency operation.

11.6 Landslides: The fragile nature of the rocks framing the mountains along with climatic conditions and various anthropogenic activities has made the state vulnerable to the vagaries of nature. Beside earthquake, landslides are the other geological hazards that are common and peculiar to the state.

Landslides are the downslide movement of soil, debris or rock resulting from natural causes vibrations, overburden of rock material removal of lateral supports, change in the water content of rock or soil bodies, block drainage etc. In Himachal Pradesh the mass movement varies in magnitude from soil creep to landslides, Solifluction (A form of creep in which snow or water saturated rocks move down the slope) is another type of mass movement that is common in the higher snow covered ranges of the state.

Immediate steps for imminent Landslide:

- i. Contact your local Fire, Police or Public Works Department.
- ii. Inform affected neighbours
- iii. Leave the area quickly

Actions to be taken before Intense Rainfall:

- i. Become familiar with the land around you. Slopes, where landslides or debris flows have occurred in the past, are likely to experience them in the future.
- ii. Buildings should be located away from known landslides, debris flows, steep slopes, streams and rivers, intermittent-stream channels, and the mouths of mountain channels.
- iii. Observe the patterns of storm-water drainage on slopes near your home, and watch especially the places where runoff water converges, increasing flow over soil covered slopes. Observe the hillsides around your home for any signs of land movement, such as small landslides or debris flows or progressively tilting trees.
- iv. Contact your local authorities to learn about the disaster management response and develop your own emergency plans for your family and business.

During Intense Rainfall:

- i. Be observant. Many landslide and debris flow casualties occur when people are sleeping. Listen to radio for warnings of intense rainfall. Intense short bursts of rain may be particularly dangerous, especially after longer periods of heavy rainfall and damp weather.
- ii. Unusual sounds might indicate moving debris, such as trees cracking or boulders knocking together. A trickle of flowing or falling mud or debris may precede larger landslides. Be alert for any sudden increase or decrease in water flow in streams or channels. Such changes may indicate landslide activity upstream, so be prepared to move quickly.
- iii. If you live in areas susceptible to landslides and debris flows, consider leaving if it is safe to do so. If you remain at home, move to a part of the house farthest away from the source of the landslide or debris flows, such as an upper floor, but keep an escape route open should it become necessary to leave the house.

- iv. Be alert when on the roads. Embankments along roadsides are particularly susceptible to landslides. Watch the road for collapsed pavement, mud, fallen rocks, and other indications of possible landslides or debris flows. Be observant. Many landslide and debris flow casualties occur when people are sleeping. Listen to radio for warnings of intense rainfall. Intense short bursts of rain may be particularly dangerous, especially after longer periods of heavy rainfall and damp weather.
- v. Unusual sounds might indicate moving debris, such as trees cracking or boulders knocking together. A trickle of flowing or falling mud or debris may precede larger landslides. Be alert for any sudden increase or decrease in water now in streams or creeks. Such changes may indicate landslide activity upstream, so be prepared to move quickly.
- vi. If you live in areas susceptible to landslides and debris flows, consider leaving if it is safe to do so. If you remain at home, move to a part of the house farthest away from the source of the landslide or debris flows, such as an upper floor, but keep an escape route open should it become necessary to leave the house.
- vii. Be alert when on the roads. Embankments along roadsides are particularly susceptible to landslides. Watch the road for collapsed pavement, mud, fallen rocks, and other indications of possible landslides or debris flows.

After Intense Rainfall: Be alert for signs indicating land movement. Landslides can occur weeks or months after intense storms.

Things to Remember

- i. Mudflows tend to flow in channels, but will often spread out over a floodplain. They generally occur in places where they have occurred before
- ii. Landslides and mudflows usually strike without much appreciable warning. The force of rocks, soil, or other debris moving down a slope can devastate anything in its path. Take the following steps to be ready:
 - a. Plant ground cover on slopes and build retaining walls.
 - b. In mudflow areas, build channels or deflection walls to direct the flow around buildings.
 - c. Remember: If you build walls to divert debris flow and the flow lands on a neighbour's property, you may be liable for damages.

Precautions to be taken during landslides

If inside a building:

- i. Stay inside.
- ii. Take cover under a desk, table, or other piece of sturdy furniture.

If outdoors:

- i. Try and get out of the path of the landslide or mudflow.
- ii. Run to the nearest high ground in a direction away from the path.
- iii. If rocks and other debris are approaching, run for the nearest shelter such as a group of trees or a building.
- iv. If escape is not possible, curl into a tight ball and protect your head.

After Landslide

- i. Stay away from the slide area. There may be danger of additional slides.
- ii. Check for injured and trapped persons near the slide area. Give first aid if trained.
- iii. Remember to help your neighbors who may require special assistance—infants, elderly people, and people with disabilities.
- iv. Listen to a radio or television for the latest emergency information.
- v. Stay away from the slide area. There may be danger of additional slides.
- vi. Check for damaged utility lines. Report any damage to the utility company.
- vii. Check the building foundation, chimney, and surrounding land for damage.
- viii. Replant damaged ground as soon as possible since erosion caused by loss of ground cover can lead to flash flooding.

CHAPTER-12
CONSTRUCTION UNDERNEATH OVERHEAD LINES

Construction (Temporary or Permanent) under over head EHV.HT /LT line is not safe for the people and can further hinder the performance of electric lines, the construction under overhead lines may be allowed as per relevant regulations of the Central Electricity Authority(Measures relating to Safety and Electric Supply). Regulations2010 and provisions of the Electricity Act.2003 and it shall be ensured that construction under overhead lines shall comply with Standard Regulations, the standard procedure as under:-

Regulation 63 of Central Electricity Authority (Measures relating to Safety, and Electric Supply), Regulations2010.

Erection of or alternation to buildings, structures, flood banks and elevation of roads

1. If at any time subsequent to the erection of an overhead line, whether covered with insulating material or not, any person proposes to erect a new building or structure or food bank or to raise any road level or to carry out any other type of work whether permanent or temporary or to make in or upon any building or structure of flood bank or road, any permanent or temporary addition or alternation, he and the contractor whom he employs to carry out the erection. addition or alteration, shall give information in writing of his intention to do so, to the supplier or owner and to the Electrical Inspector and shall furnish therewith a scale drawing showing the proposed building, structure , flood bank or any addition or alteration and scaffolding thereof required during the construction.
2. On receipt of such information, the supplier or owner shall examine:
 - i. whether the line under reference was laid in accordance with the provisions of these regulations and any other law;
 - ii. whether it meets the requirement of Right of Way(ROW);
 - iii. whether such person was liable to pay the cost of alteration of the overhead line and if so, send a notice without undue delay, to such person together with an estimate of the cost of the expenditure likely to be incurred to so alter the overhead line and require him to deposit, within thirty days of the receipt of the notice, with the supplier or owner, the amount of the estimated cost.
3. If such person disputes the cost of alteration of the overhead line estimated by the supplier or owner or even the responsibility to pay such cost, the dispute may be referred to the Electrical Inspector whose decision thereof shall be final.
4. The Electrical Inspector shall estimate the cost of alteration of overhead line on the following basis, namely:
 - i. The cost of material used on the alteration after crediting the depreciated cost of the material which shall be available from the existing line;
 - ii. The wages of Labour employed in affecting the alteration;

- iii. Supervision charges to the extent of fifteen per cent of the wages mentioned in clause (ii); and charges incurred by the supplier in complying with the provisions of section 67 of the Act in respect of such alterations.
- 5. Any addition or alteration to the building or structure shall be allowed only after the dispute of such estimated cost to the supplier or owner.
- 6. No work upon such building, structure, flood bank, road and addition or alternation thereto shall be commenced or continued until the Electrical inspector has certified that the provisions of regulation 58.60 or 61 should not be contravened either during or after the aforesaid construction.
Provided that the Electrical Inspector may, if he is satisfied that the overhead line has been so guarded as to secure the protection of persons or property from injury, certify that the work may be executed prior to the alteration of the overhead line or in the case of temporary addition or alteration, without alteration of the overhead line.
- 7. The supplier or owner, on receipt of such deposit, after the overhead line in such a way that it does not contravene the provisions of regulations 58, 60 or 61 either during or after such construction within two months from the date of such deposit or within such longer period as the Electrical Inspector may allow.

Regulation 58 of Central Electricity Authority (Measures relating to Safety and Electric Supply), Regulations 2010:-

Clearance above ground of the lowest conductor of overhead lines:-

1. No conductor of an overhead line, including service lines, erected across a street shall at any part be at a height of less than
 - i. for lines voltage not exceeding 650 volts: 5.8 metres
 - ii. for line voltage exceeding 650 volts but: 6.1metres
not exceeet1ing 33 kV
2. No conductor of an overhead line, including service lines, erected along any street shall at any part thereof be at d height less than
 - i. for lines of voltage not exceeding 650 Volts: 5.5 metres
 - ii. for lines exceeding 650 volts not exceeding: 5.8 metres
33 kV
3. No conductor of in overhead line including service lines, erected elsewhere than along or across any street shall be at a height less than
 - i. for lines of voltage up to and including : 4.6 metres
and including 11,000 volts, if bare
 - ii. for lines of voltage up to and including: 4.0 metres
11,000 volts, if insulated
 - iii. for lines voltage exceeding 11.000 volts: 5.2 metres
But not exceeding 33 kV

4. For lines of voltage exceeding 33 kV the clearance above ground shall not be less than 5.2 metres plus 0.3 metre for every 33,000 volts or part thereof by which the voltage of the line exceeds 33,000 volts.

Provided that the minimum clearance along or across any street shall not be less than 6.1 metres.

Regulation 60 of Central Electricity Authority (Measures relating to Safety and Electric Supply), Regulations 2010 :-

Clearances from buildings of lines of voltage and service lines not exceeding 650 volts:-

1. An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.
2. Where an overhead line of voltage not exceeding 650 V passes above or adjacent to or terminates on any building, the following minimum clearances from any accessible point, on the basis of maximum sag, shall be observed, namely:
 - i. For any flat roof, open balcony, verandah roof and lean-to-roof-
 - a. When the line passes above the building a vertical clearance of 2.5 metres from the highest point.
 - b. When the line passes adjacent to the building a horizontal clearance of 1.2 metres from the nearest point.
 - ii. For pitched roof-
 - a. When the line passes above the building a vertical clearance of 2.5 metres immediately under the lines.
 - b. When the line passes adjacent to the building a horizontal clearance of 1.2 metres.
3. Any conductor so situated as to have a clearance less than that specified above shall be adequately insulated and shall be attached at suitable intervals to a bare earthed bearer wire having a breaking strength of not less than 350 kg.
4. The horizontal clearance shall be measured when the line is at a maximum deflection from the vertical due to wind pressure.

Explanation: - For the purpose of this regulation, expression "building" shall be deemed to include any structure, whether permanent or temporary.

Regulation 61 of Central Electricity Authority (Measures relating to Safety and Electric Supply), Regulations 2010:-

Clearances from buildings of lines of voltage exceeding 650 Volts-

1. An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line.
2. Where an overhead line of voltage exceeding 650 V passes above or adjacent to any building or part of a building it shall have on the basis of maximum sag a vertical clearance above the highest part of the building immediately under such line, of not less than

- i. for lines of voltage exceeding 6S0 Volts up to : 3.7 metres
and including 33,000 volts
 - ii. For lines of voltage exceeding 33 kV: 3.7 metres plus 0.30 metre for
every additional 33,000 volts
or part thereof.
3. The horizontal clearance between the nearest conductor and any part of such building shall, on the basis of maximum deflection due to wind pressure, be not less than-
- i. for lines of voltage exceeding 6S0 V upto: 1.2 metres
and including 11,000 volts
 - ii. for lines of voltage exceeding 11,000 V and upto: 2.0 metres
including 33,U00 volts
 - iii. for lines of voltage exceeding 33 kV : : 2.0 metres plus 0.3 metre
for every additional 33,000 volts
for part thereof.

Explanation:-For the purpose of this regulation, expression "building" shall be deemed to include any structure, whether permanent or temporary.

The Construction of Structure shall comply with the above rules otherwise the construction shall be treated as unauthorized construction and rule 68(5) of Electricity Act, 2003 states as under:

Where any tree standing or lying near an overhead line or where any structure or other object which has been placed or has fallen near all overhead line subsequent to the placing of such line, interrupts or interferes with, or is likely to interrupt or interfere with, the conveyance or transmission of electricity or the accessibility of any works, an Executive Magistrate or authority specified by the Appropriate Government may, on the application of the licensee, cause the tree, structure or object to be removed or otherwise dealt with as he or it thinks fit.

In addition to above clearances over river, tree clearance, clearance from supporting structures of another line are also given as under:

Clearance over the rivers: Minimum 10' (3.048 meters) over highest flood level for rivers, which are not navigable. For navigable rivers, clearance to be fixed in relation to the tallest mast in consultation with the concerned navigation authorities.

Tree clearance:

- I. For E.H.V.T. lines all tall tree within 40' (12.19 meters) on either side of the line and all trees which are falling or would fall. To be cut.
- II. All bust growth 20' (6.095m) on either side to be completely cleared grafted fruit trees, which will not grow tall, may be left out.
- III. Al branches or leaves, which are within 3' (0.914m) from the conductors, neutral and earth wires in case of L.T. line, should be cut.

Clearance between supporting structures of another line:

The vertical clearance between the guard wire and any conductor under maximum sag shall be as under:

I.	L.T. voltages	1.219m
II.	High Voltage upto 33kv	1.219m

Every guard wire shall be securely bound to earth at each where its electrical continuity is broken.

Guard wires shall have an actual breaking load of not less than 1400 lbs (635 kgs) and shall be galvanized.

Chapter-13

CAPACITOR KVAR AT DIFFERENT MOTOR RATINGS AND SPEEDS

HP	750rpm	1000rpm	1500rpm
3	2	1.5	1.0
5	3.5	2.5	2.5
7.5	5	4	3
10	6	5	4
15	8.5	6.5	5.5
20	11	9	7
25	13.5	11	9
30	15.5	13.5	10.5
40	20.5	17	14.5
50	25.5	20	18
60	29.5	24	21.5
75	33.5	28.5	25.5
90	40	34	30.5
100	44.5	36	34
120	53.5	43	40.5
130	58	46.5	44
150	66.5	53.5	50.5
160	71	57	54

Reference Table amps per MVA

MVA	11KV	33KV	66KV	132KV	220KV	400KV
1	52.5	17	8.7	4.3	2.62	1.4
2	105	35	17.5	8.7	4.4	2.9
3	157.5	52	26.2	13.0	6.6	4.8
4	209.9	70	35.0	17.5	8.7	5.7
5	262.4	87	43.7	21.9	10.9	7.2
6	314.9	105	52.5	26.2	13.1	8.7
7	367.4	122	61.2	30.6	15.3	10.8
8	419.9	140	70.0	35.0	17.5	11.5
9	472.4	157	78.7	39.4	19.7	13.0
10	524.9	175	87.0	43.7	21.9	14.4
11	577.4	192	96	48.1	24.0	15.9
12	629.8	210	105	52.5	26.2	13.3
13	682.3	227	114	56.9	28.4	18.8

14	734.8	245	122	61.2	30.6	20.2
15	787.3	262	131	65.6	32.8	21.6
16	839.8	280	140	70.0	35.0	23.8
17	892.3	297	149	74.3	37.1	24.5
18	944.8	315	157	78.7	39.4	26.0
19	997.0	332	166	83.1	41.5	27.4
20	1050.0	350	175	87.5	43.7	28.9
25	1312	437	219	109	54.7	36.8
30	1575	525	262	131	65.6	43.3
35	1837	612	306	153	76.5	50.5
40	2099	700	350	175	87.5	57.7
45	2362	787	394	197	98.4	65.0
50	2624	875	437	218	109.3	72.2
60	3149	1050	525	262	131.2	86.6
70	3674	1225	612	306	153	101
80	4199	1400	700	350	175	115
90	4724	1575	787	394	197	130

Loading on the Basis of Ambient Temperatures

Type of Cooling	Percentage of rated KVA	
	Decrease load for Each degree C higher Temp.	Increase load for Each degree C lower Temp.
Self cooled	1.5	1.0
Water cooled	1.5	1.0
Forced air	1.0	0.75
Forced oil cooled	1.0	0.75

Current Ratings and Fuse wire (Tinned Copper)

Sizes of Sub Station

Capacity of	Current rating	Fuse wire	Current L.T.	Fuse wire
T/F in KVA	11KV side	SWG	Side	SWG
25	3 Amps	33	30 Amps	21
50	5 Amps	35	50 Amps	18
75	5 Amps	30	106 Amps	2 of 18
100	10.5 Amps	30	120 Amps	2 of 18

Horn Gap Fuses (H.T. side of TFs)

	33KV (Gap 385mm)		11KF(Gap 205mm)	
3MVA	18SWG 500	KVA 20	SWG 100	KVA 33SWG
2MVA	19SWG 300	KVA 23	SWG 63	KVA 35SWG
1MVA	22SWG 200	KVA 24	SWG 25	KVA 38SWG
0.5MVA	26SWG			

Min safe IR Value of Megaohms at different temperature of power T/F windings (Use 1000V megger)

Rate Voltage of the windings	30°C	45°C	50°C	60°C
66KV & above	800	300	150	75
33KV	600	250	125	65
66KV & 11KV	400	200	100	50
Below 6.6KV	200	100	50	25

HV/LV Ampere ratings of T/Fs

Power	LV-Amps	HV-Amps for rated KV of		
T/F KVA	11KV	33KV	66KV	132KV
500	26.25	8.75	4.4	2.2
1000	52.50	17.50	8.75	4.37
1500	78.75	26.25	13.12	6.56
2000	105.00	35.00	17.50	8.75
3000	157.50	52.50	26.75	13.37
5000	262.50	87.50	43.75	21.87
10000	525.00	175.00	87.50	43.75

Weight of Copper Conductor

Size	Wt/km	M/kg	Size	Wt/km	M/kg
No.9SWG	472.9kg	2.11	No.8SWG	115.00kg	8.67 km
2SWG	343.2kg	2.91	10	73.71 kg	13.55
4	242.4kg	4.13	7/0.074	122.7kg	8.15
6	166.6kg	6.02	(Standard)		

Conductor Characteristics Based on I.S. 398/1961

Electrical Characteristics					Mechanical Characteristics			
Code	Equiv.		Resisat	App. A	Strands	Conductor		
	Cut wire	Cu/Alu are in	20 COH M/KM	Carring g cap at	Al/St Dia in	Total Dia mm	Wt. inkg.km	Appro Ultimate
	SWG	Sq.inch		40 ⁰ C 45 ⁰ C	mm			Tensile strength kg

All Aluminium Conductor

ROSE	8	0.02/20.0	1.361	116	108	7/1.96	5.88	58	362
GNAT	7	0.25/26.56	1.071	133	123	7/2.21	6.63	73	485
IRIS	6	0.030/33.0	0.850	150	138	7/2.48	7.44	92	582
PANSY	4	0.040/42.0	0.677	178	165	7/2.78	8.34	116	730
ANT	3	0.05/52.00	0.544	204	189	7/3.10	9.30	144	892
ASTER	2	0.065/66.96	0.423	239	196	7/3.51	10.53	184	1157

A.C.S.R. Conductors

SQrl	0.02	8.13/20.7	1.374	115	107	6/1/2.11	6.33	85	771
Weasel	0.03	620/31.2	0.911	150	139	6/1/2.59	7.77	128	1136
Ferret	0.04	4.525/41.8	0.679	181	168	6/1/3.0	9.00	171	1503
Mink	0.6	240/62.3	0.456	234	217	6/1/4.09	12.27	255	2107
RANCO	0.075	48/7780	0.365	270	250	6/1/4.09	12.27	318	2746
Dog 0.1	2.0	65/103.6	0.275	325	300	6/1/4.09	12.27	318	2746
Tiger 0.125	3.0	80/128.0	0.222	382	354	30/7/2.36	16.62	604	5758
Wolf 0.15	5.0	95/154.3	0.184	430	398	30/7/2.59	18.13	727	6880
LYNX 0.175	6.0	110/179.0	0.158	475	440	30/7/2.79	19.53	844	7950
Panther 0.2	-	130/207.0	0.137	520	482	30/7/3.0	21.00	976	9127
Lion 0.225	-	140/232.5	0.122	555	515	30/7/3.18	22.26	1097	10210
Goat 0.3	-	185/316.5	0.089	680	630	30/7/3.71	25.97	1492	13780
Gofer	-	0.5449							
Zebra	-	360/416	0.068	795	736	54/7/3.18	28.62	1623	
Moose	-	325/517.7	0.05517	900	736	54/7/3.53	31.77	-	-

Number of units in the tension string of normal lines

System Voltage	No. of discs	Dry f.o.v.KV	Wet f.o.v.KV	Impulse f.o.v.KV	1*50ms+ ve wave
11	1	78	45	120	
22	2	135	75	230	
66	5/6	285/335	180/210	460/535	
132	7	380	240	610	
132	9/10	470/515	310/345	750/825	
220	14/15	690/720	465/495	1100/1175	

Spares allowable on the basis of ground clearance as per I.E. rules

Height of pole in M	Type of formation with AAC 8/6/4 SWG	No. of Wires	Across the road	Span in m along the road	Elsewhere than along or Across the road
8	Vertical	5	-	-	60.96 (200)
		4	-	30.48 (100)	68.58 (225)
		3	30.48 (100)	45.72 (150)	68.58 (225)
8	Horizontal	5	30.48 (100)	45.72 (150)	68.58
		3	45.72 (150)	60.96 (200)	68.58 (225)
9	Vertical	5	45.72 (150)	60.96 (200)	As it would not be advantageous
		4	45.72 (150)	60.96 (200)	To use 9 meter poles in cross country, the spans are not given
		3	60.96 (200)	67.056 (220)	
9	Horizontal	5	67.056 (220)	67.056 (220)	It would not be advisable to employ a span more than 225ft.
		4	67.056 (220)	67.056 (220)	

Note: The spans along or across a road are restricted to 220 only as per I.E. Rule 85.

Limits of earth Resistance

Large Power Stations 0.5 Ohm

Major Sub Stations 1.0 Ohm

Small Stations 2.0 Ohm

Tower Footing Station 15.0 Ohm

Distribution 10.0 Ohm

Number of Damper per Span

1. Span up to 450 mts used 2 stocks Bridge Damper per span.
2. Span between 450 mtrs& 900 mts. Used 4 stock Bridge Damper per span.
3. Span above 900 mts used 6 stocks Bridge Damper per span.

CHAPTER- 14

FIELD QUALITY PLAN FOR TRANSMISSION LINE

TABLE OF CONTENTS

OVER HEAD POWER TRANSMISSION LINE CONSTRUCTION

S. No.	Activity Description	Reference Document
1.	Quality Control	Standard Field Quality Plan (Containing Quality Control Parameters from Preliminary Survey to Commissioning of Transmission Line)
2.	Site Registers	Site Order Book Hindrance Register
3.	Survey	Topographical Sheets for route alignment Tower Spotting Data & Route Alignment for Detail Survey Detail Survey Report for Check Survey
4.	Foundation	Check List of Pit Marking Check List of Stub Setting Check List of Construction Material Check List of Reinforcement & Form Boxes Pour Card Check List of Placing, Mixing & Compaction of Concrete Joint Measurement Certificate
5.	Tower Erection	Check List of Tower Erection Works Joint Measurement Certificate
6.	Stringing	Check List Cum Joint Measurement of Earthing Works Checklist of Stringing Works Detail of Conductor & OPGW/Earth Wire Detail of MSJ & Repair Sleeves Record of Insulators Sag Measurement for Conductor & OPGW / Earth Wire Detail of Suspension & Tension Clamps for EW/OPGW Record of Vibration Dampers for OPGW & Earth Wire
7.	Final Checking	Punch List of Remarks / Observations
8.	Testing & Commissioning	Conductor Continuity Test & Test Charge

STANDARD FIELD QUALITY PLAN FOR TRANSMISSION LINE

S. No.	Description of Activity	Items to be checked	Tests/Checks to be done	Ref. Documents	Action Required		
					To be checked	To be reviewed	To be approved
1.	Preliminary / Detail Survey	a) Route alignment	Optimization of route length	a) Preliminary survey b) Topographical maps c) Tower spotting data	Contractor	PIC	PEA/Client
		b) Route profiling & tower spotting	1. Ground clearance 2. Cold weight span 3. Hot weight span 4. Wind Span 5. Angle of Deviation 6. Suitability of tower spotting in hilly area 7. Unequal leg Extensions	a) Sag template b) Tower spotting data c) Route alignment	Contractor	PIC	PEA/Client
2.	Check Survey	Tower location & Final length	1. Alignment 2. Final length 3. Angle of deviation & pit marking	a) Route alignment b) Tower schedule c) Profile	Contractor	PIC	PEA/Client

3.	Detail Investigation	Soil	a) Bore log	1. Depth of borelog 2. SPT test 3. Collection of samples	As per technical specification	Contractor	PIC	PEA/Client
			b) Tests on samples	As per technical specification	As per technical specification	Contractor	PIC	PEA/Client
			c) Special foundations	As per technical specification	As per technical specification	Contractor	PIC	PEA/Client

S. No.	Description of Activity	Items to be checked	Tests/Checks to be done	Ref. Documents	Action Required		
					To be checked	To be reviewed	To be approved
4.	Revetment	RR Masonry	a) Size of stone	CPWD Specifications	Contractor	PIC	PEA/Client
			b) Water absorption	-Do-	Contractor	PIC	PEA/Client
			c) Cement: Sand ratio in mortar	As per technical specification	Contractor	PIC	PEA/Client
5.	Benching	Checking of reduced level	Reduced level	As per approved drawings.	Contractor	PIC	PEA/Client
6.	Tower Foundation				Contractor	PIC	PEA/Client
		A) Material 1. Cement	1. Brand approval	As per list of approved brands of HPSEBL	Contractor	PIC	PEA/Client
			2. Physical Test	As per annexure-I of SFQP	Contractor	PIC	PEA/Client
			3. Chemical Tests	As per annexure-I of SFQP	Contractor	PIC	PEA/Client
		2. Reinforcement Steel	Source Approval	May be procured either from main producers directly or through authorised dealer who can produce MTC from main producers with traceability	Contractor	PIC	PEA/Client
			2. Physical & Chemical analysis tests	As per annexure-2 of this SFQP	Contractor	PIC	PEA/Client
		3. Coarse Aggregate	1. Source approval	As per approved list of HPSEBL	Contractor	PIC	PEA/Client

S. No.	Description of Activity	Items to be checked	Tests/Checks to be done	Ref. Documents	Action Required		
					To be checked	To be reviewed	To be approved
			2. Physical Tests	As per annexure-3 of this FQP	Contractor	PIC	PEA/Client
		4. Fine Aggregate	1. Source approval	As per approved list of HPSEBL	Contractor	PIC	PEA/Client
			2. Physical Test	As per annexure-4 of this FQP	Contractor	PIC	PEA/Client
		5. Water	1. Cleanliness	As per technical specification	Contractor	PIC	PEA/Client
			2. Ph Value	-Do-	Contractor	PIC	PEA/Client
		B) Foundation Classification	1. Visual observations of soil strata	1. Bore log data 2. Soil Investigation Report 3. Technical specifications	Contractor	PIC	PEA/Client
			2. Ground water level		Contractor	PIC	PEA/Client
			3. History of water table in nearby area/ surface water		Contractor	PIC	PEA/Client
			4. Fissured rock / hard rock		Contractor	PIC	PEA/Client
	C) Concrete Works						
	1.Before Concreting	1. Bottom of excavated earth	Depth of foundation	Approved construction drawings	Contractor	PIC	PEA/Client
		2. PCC Grade, thickness & size	Completeness	IS:456, technical spec. and approved drawings	Contractor	PIC	PEA/Client

		3. Stub setting	1. Centre line 2. Diagonals 3. Level of stubs 4. Back to back	Approved construction drawings	Contractor	PIC	PEA/Client
		4. Reinforcement Steel	Bar bending schedule	Approved construction drawings	Contractor	PIC	PEA/Client

S. No.	Description of Activity	Items to be checked	Tests/Checks to be done	Ref. Documents	Action Required		
					To be checked	To be reviewed	To be approved
	2. During Concreting	1. Workability	Slump test	Annexure-5 of SFQP	Contractor	PIC	PEA/Client
		2. Concrete Strength	Cubes compressive strength	Annexure-5 of SFQP	Contractor	PIC	PEA/Client
		3. Chimney Concrete	Top level of chimney w.r.t GL	Approved Drawings	Contractor	PIC	PEA/Client
	3. After Concreting	Backfilling, compaction and levelling	Completeness	As per specifications	Contractor	PIC	PEA/Client
7.	Tower Erection	1. Material of tower parts/bolt-nuts, washers & accessories.	Visual checking for 1. Stacking 2. Cleanliness 3. Galvanizing 4. Damages	Approved Drgs./ Bill of Material & Technical Specification	Contractor	PIC	PEA/Client
		2. Erection of superstructures	1. Sequence of erection	As per approved drawings & specifications	Contractor	PIC	PEA/Client
			2. Checking for completeness	As per approved drawings & specifications	Contractor	PIC	PEA/Client
			3. Tightening of nut and bolts	As per approved drawings & specifications	Contractor	PIC	PEA/Client

			4. Checking for verticality	As per approved drawings & specifications.	Contractor	PIC	PEA/Client
			5. Tack welding for nut & bolts	As per specification.	Contractor	PIC	PEA/Client
		3. Tower Footing Resistance (TFR)	TFR at locations before and after verticality	As per specifications.	Contractor	PIC	PEA/Client

S. No.	Description of Activity	Items to be checked	Tests/Checks to be done	Ref. Documents	Action Required		
					To be checked	To be reviewed	To be approved
8.	Earthing	Pipe Type	Salt & Charcoal	As per approved drawings	Contractor	PIC	PEA/Client
		Counterpoise Type	Length & depth of earth electrode	As per approved drawings	Contractor	PIC	PEA/Client
9.	Stringing	1. Material			Contractor	PIC	PEA/Client
		a) Insulators	1. Visual check for damage, cracks, chipping, cleanliness / glazing/cracks/and white spots.	As per specifications	Contractor	PIC	PEA/Client
			2. Insulation Resistance Value	Minimum accepted value 2000 Mega-Ohms	Contractor	PIC	PEA/Client
			3. Traceability (Make/batch no./Loc. No.)	Packing list/CIP	Contractor	PIC	PEA/Client

		b) Conductor	1. Visual check of drums.	Packing list/CIP	Contractor	PIC	PEA/Client
			2. Check for seals	-do-	Contractor	PIC	PEA/Client
			3. Check depth from top of flange to the top of the outer most layer	-do-	Contractor	PIC	PEA/Client
		c) Earth wire / OPGW	Check for seals at both ends.	Packing list/CIP	Contractor	PIC	PEA/Client
		2. Field activity			Contractor	PIC	PEA/Client
		a) Before stringing	Readiness for stringing works	Stringing procedure as per specifications	Contractor	PIC	PEA/Client

S. No.	Description of Activity	Items to be checked	Tests/Checks to be done	Ref. Documents	Action Required		
					To be checked	To be reviewed	To be approved
		b) During stringing	(Conductor/ Earth wire/OPGW)				
			1. Scratch / cut check (Visual)	Approved drawings/specifications	Contractor	PIC	PEA/Client
			2. Repair sleeve	-Do-	Contractor	PIC	PEA/Client
			3. Mid span joints	-Do-	Contractor	PIC	PEA/Client
			4. Guying (in case of tower not designed for one side stringing)	As per specification	Contractor	PIC	PEA/Client
		c) After stringing	Check for				
			1. Sag/tension	Stringing chart/tower spotting data	Contractor	PIC	PEA/Client
			2. Electrical clearances	As per specifications	Contractor	PIC	PEA/Client
			a) Ground & live metal clearances	-Do-	Contractor	PIC	PEA/Client
			3. Jumpering	-Do-	Contractor	PIC	PEA/Client
			4. Copper Bond	As per approved	Contractor	PIC	PEA/Client
			5 Placement of vibration dampers	As per specifications/drawings	Contractor	PIC	PEA/Client
			6. Mid span joints	As per specifications	Contractor	PIC	PEA/Client
			7. Placement if arcing horns	As per specifications	Contractor	PIC	PEA/Client

			8. Tightening of nut- bolts as per manufacturer's recommendation	As per specifications	Contractor	PIC	PEA/Client
10.	Final checking of line	Foundation/Tower/ Stringing works	Rectification of defects	As per punch list	Contractor	PIC	PEA/Client

S. No.	Description of Activity	Items to be checked	Tests/Checks to be done	Ref. Documents	Action Required		
					To be checked	To be reviewed	To be approved
11.	Final testing a) Pre-commissioning	Readiness of lines for pre-commissioning	1. Completeness of line. 2. Megger testing of line 3. Conductor continuity test	As per pre-commissioning procedures	Contractor	PIC	PEA/Client
12.	Commissioning of lines	Readiness of lines for commissioning	Digital photograph of each tower to ascertain the completeness of tower	1. As per latest pre-commissioning procedures 2. Pre-commissioning report 3. CEA clearance	Contractor	PIC	PEA/Client

ANNEXURE- I OF SFQP
ACCEPTANCE CRITERIA AND PERMISSIBLE LIMIT FOR CEMENT

ORDINARY PORTLAND CEMENT [OPC]

S. No.	Name of the Test	OPC Grade 33 Grade as per IS 269	OPC Grade 43 as per IS 8112	OPC 53 Grade as per IS 12269	Remarks
A) Physical Tests					To be done only in approved lab
1.	Fineness	Specific surface area shall not be less than 225 sq.m per Kg.	Specific surface area shall not be less than 225 sq.m per Kg.	Specific surface area shall not be less than 225 sq.m per Kg.	Blaine's air permeability method as per IS 4031 (Part-2)/Sieve analysis as per IS 4031 (Part-3)
2.	Compressive Strength	72 ± 1 hour: Not less than 16 Mpa (16 N/mm ²) 168 ± 2 hour: Not less than 22 Mpa (22 N/mm ²) 672 ± 4 hour: Not less than 33 Mpa (33 N/mm ²)	72 ± 1 hour: Not less than 23 Mpa (23 N/mm ²) 168 ± 2 hour: Not less than 33 Mpa (33 N/mm ²) 672 ± 4 hour: Not less than 43 Mpa (43 N/mm ²)	72 ± 1 hour: Not less than 27 Mpa (27 N/mm ²) 168 ± 2 hour: Not less than 37 Mpa (37 N/mm ²) 672 ± 4 hour: Not less than 53 Mpa (53 N/mm ²)	As per IS 4031 (Part-6)
3.	Initial & Final setting time	Initial setting time: Not less than 30 minutes Final setting time: Not less than 600 minutes	Initial setting time: Not less than 30 minutes Final setting time: Not less than 600 minutes	Initial setting time: Not less than 30 minutes Final setting time: Not less than 600 minutes	As per IS 4031 (Part-5)
4.	Soundness	Unaerated cement shall not have an expansion of more than 10 mm when tested by Le Chatlier and 0.8% by Autoclave test	Unaerated cement shall not have an expansion of more than 10 mm when tested by Le Chatlier and 0.8% by Autoclave test	Unaerated cement shall not have an expansion of more than 10 mm when tested by Le Chatlier and 0.8% by Autoclave test	Le Chatlier and Autoclave test as per IS 4031 (Part-3)

Note: All physical tests are required to be performed in approved lab, Review of 100 % MTC and testing of one sample for every batch number of manufacturer of a particular brand.

S. No.	Name of the Test	OPC Grade 33 Grade as per IS 269	OPC Grade 43 as per IS 8112	OPC 53 Grade as per IS 12269	Remarks
B Chemical Composition Tests					Review of MTC only
1.		Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02 %	Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02 %	Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02 %	
2.		Ration of percentage of alumina to that of iron oxide minimum 0.66 %	Ration of percentage of alumina to that of iron oxide minimum 0.66 %	Ration of percentage of alumina to that of iron oxide minimum 0.66 %	
3.		Insoluble residue percentage by mass Max. 4.00%	Insoluble residue percentage by mass Max. 2.00%	Insoluble residue percentage by mass Max. 2.00%	
4.		Magnesia percentage by mass 6% (Maximum)	Magnesia percentage by mass 6% (Maximum)	Magnesia percentage by mass 6% (Maximum)	
5.		Total sulphur content calculated as sulphuric anhydride (SO ₃), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percentage by mass is 5 or less and greater than 5 respectively	Total sulphur content calculated as sulphuric anhydride (SO ₃), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percentage by mass is 5 or less and greater than 5 respectively	Total sulphur content calculated as sulphuric anhydride (SO ₃), percentage by mass not more than 2.5 and 3.0 when tri-calcium aluminate percentage by mass is 5 or less and greater than 5 respectively	
6.		Total loss on ignition shall not be more than 5 %	Total loss on ignition shall not be more than 5 %	Total loss on ignition shall not be more than 5 %	

Note: Chemical composition tests of cement are not required to perform in lab, only review of Manufacturer's Test Certificate (MTC) is to be done.

PORTLAND POZZOLANA CEMENT [PPC] AS PER IS 1489/2005

S. No.	Name of test	Acceptance Criteria	Remarks
	Physical Tests		All physical tests to be done in approved lab only
1.	Fineness	Specific surface area shall not be less than 300 sq.m per Kg. or 3000 Cm ² /gm	
2.	Compressive Strength	a) 72 ± 1 hour: Not less than 16 Mpa (16 N/mm ²) b) 168 ± 2 hour: Not less than 22 Mpa (22 N/mm ²) c) 672 ± 4 hour: Not less than 33 Mpa (33 N/mm ²)	
3.	Initial & Final setting time	Initial setting time: Not less than 30 minutes Final setting time: Not more than 600 minutes	
4.	Soundness	Un-aerated cement shall not have an expansion of more than 10 mm Le Chatlier test and) 0.8 % by autometric test as per IS 4031 (Part-3)	
	Chemical Composition Tests		Review of Manufacture's Test Certificate (MTC) only
1.	Magnesia percentage by mass max. 6%		
2.	Insoluble material percentage by mass + 4 (100-x)/100, where x is the declared % of pozzolana in the PPC		
3.	Total sulphur content as sulphuric anhydride (SO ₃), percentage by mass not more than 3.0		
4.	Total loss on ignition shall not be more than 5 %		

ANNEXURE- II OF SFQP

**Acceptance Criteria and Permissible Limit for Reinforcement Steel as per IS 1786-1985 Edition-4.3
(2004-2012)**

S. No.	Name of Test	Fe 415	Fe 500
1.	Physical Tests		
a)	Tensile strength minimum	10 % more than actual 0.2 % proof stress but not less than 485 N/mm ²	8 % more than actual 0.2 % proof stress but not less than 545 N/mm ²
b)	0.2 % of proof stress / Yield stress minimum, N/mm ²	415	500
c)	Elongation percentage minimum	14.5	12
2.	Bend & Re-bend Test	Pass	Pass
3.	Chemical Analysis Tests		
a)	Carbon	0.30 % Maximum	0.30 % Maximum
b)	Sulphur	0.060 % Maximum	0.055 % Maximum
c)	Phosphorous	0.060 % Maximum	0.055 % Maximum
d)	Sulphur & Phosphorus	0.11 % Maximum	0.105 % Maximum

Note: All physical & bend re-bend tests are to be performed in approved lab, Review of MTC and testing of one sample of 10 mm steel & above size per 500 MT and unit weight of three samples for each size of steel shall be witnessed.

ANNEXURE-III OF SFQP

Acceptance Criteria and Permissible Limit for Coarse Aggregate as per IS 383

Physical Tests

S. No.	Physical Tests										
1.	Determination of Particle Size	IS Sieve Designation	Percentage Passing for Single Sized Aggregate of Nominal Size					Percentage Passing for Graded Aggregate of Nominal Size			
			40 mm	20 mm	16 mm	12.5 mm	10 mm	40 mm	20 mm	16 mm	12.5 mm
		63 mm	100	--	--	--	--	--	--	--	--
		40 mm	85 to 100	100	--	--	--	95 to 100	100	--	--
		20 mm	0 to 20	85 to 100	100	--	--	30 to 70	95 to 100	100	100
		16 mm	--	--	85 to 100	100	--	--	--	90-100	--
		12.5 mm	--	--	--	85 to 100	100	--	--	--	90 to 100
		10 mm	0 to 5	0 to 20	0 to 30	0 to 45	85 to 100	10 to 35	25 to 55	30 to 70	40 to 85
		4.75 mm	--	0 to 5	0 to 5	0 to 10	0 to 20	0 to 5	0 to 10	0 to 10	0 to 10
		2.36 mm	--	--	--	--	0 to 5	--	--	--	--
2.	Flakiness Index		Not to exceed 25 %								
3.	Crushing Value		Not to exceed 45 %								
4.	Presence of deleterious material		Not to exceed 5%								
5.	Hardness		Abrasion value not more than 50 %, Impact value not more than 45 %								
6.	Soundness test (for concrete work subject to frost action)		Not to exceed 12 % when tested with sodium sulphate & 18 % with magnesium sulphate								

Note: All physical tests shall be carried out at approved lab, one sample per 500 Cubic Meter or part thereof per source shall be tested.

ANNEXURE- IV OF SFQP

Acceptance Criteria and Permissible Limit for Fine Aggregate as per IS 383

Physical Tests

S. No.	Name of Tests	IS Sieve Designation	Percentage Criteria		
			Fine Aggregate Zone-I	Fine Aggregate Zone-II	Fine Aggregate Zone-III
1.	Determination of particle size				
		10 mm	100 mm	100 mm	100 mm
		4.75 mm	90 - 100 mm	90 - 100 mm	90 - 100 mm
		2.36 mm	60 - 95 mm	75 - 100 mm	85 - 100 mm
		1.18 mm	30 - 70 mm	55 - 90 mm	75 - 100 mm
		600 microns	15 - 34 mm	35 - 59 mm	60 - 79 mm
		300 microns	5 - 20 mm	8 - 30 mm	12 - 40 mm
		150 microns	0 - 10 mm	0 - 10 mm	0 - 10 mm
2.	Silt Content		Not to exceed 8%	Not to exceed 8%	Not to exceed 8%
3.	Presence of deleterious material	Total presence of deleterious material not to exceed 5 %			
4.	Soundness applicable to concrete work subject to frost action	12 % when tested with sodium sulphate and 15 % when tested with magnesium sulphate			

Note: All physical tests shall be carried out at approved lab, one sample per 500 Cubic Meter or part thereof per source shall be tested.

ANNEXURE-V OF SFQP

Acceptance Criteria and Permissible Limit for Concrete Work

Concrete	a) Workability	Slump shall be recorded by slump cone and it must be in range of 25-55 mm
	b) Compressive Strength	<p>For nominal (volumetric) concrete mixes compressive strength for M20, 1:1.5:3 (Cement: Fine Aggregate: Coarse Aggregate) concrete 28 days strength shall be min 265 Kg/cm² and for M15, 1:2:4 (Cement: Fine Aggregate: Coarse Aggregate) nominal mix concrete 28 days strength shall be min 210 Kg/cm².</p> <p>Concrete Cube Sampling per Day of Concreting</p> <p>One sample consisting of three cubes at each location shall be taken if all legs are being casted continuously without interruption otherwise three additional cubes shall be taken for every subsequent continuous casting or in alternate as per IS-456 one cube per five cubic meter of concreting to be taken.</p>

Notes:

1. On the basis of mandatory lab test results, in case of actual average compressive strength being less than specified strength but up to 70% of specified value, concrete may be accepted and rate payable shall be in the same proportion as the actual average compressive strength bears to specified compressive strength, however, in case cube strength of any one leg on any location is found to be in between 70 % to 100 % of specified value, all four legs of the respective location shall be analysed. Root cause analysis has to be carried out with NDT [Non Destructive Testing] by REBOUND HAMMER TEST to verify the quality and strength of foundation. If results are not satisfactory acceptable penalty such as re-doing of complete foundation/legs, cost towards supervision charges shall be levied from contractor towards the sub-standard works, with the approval of client/HPSEBL.
2. If the actual strength of accepted sample is less than 70 % of specified strength, PIC/PEA may reject the defective portion of work represent by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at the risk and cost of contractor.
3. Cement for concrete work needs to be used in the order of its receipt at store [FIFO-First in First out] basis, it should not be more than 6 weeks old from the date of manufacture, in case the cement remains in the storage for more than three months, the cement needs to be retested to find its suitability for further use for concrete works, if it fails to conform to any of requirement given in the Indian Standard it needs to be discarded for further use.

ANNEXURE-VI OF SFQP

Engineering Guidelines and Acceptance Criteria for Soil Investigation Work

Normal Foundation

1. The soil investigation report should be carried out in line with technical specification, it needs to be signed by the soil investigating agency, contractor and reviewed by PIC and approved by PEA/Client.
2. Soil investigation report should contain the bore log sheet indicating the variation of different soil strata.
3. The Bearing capacity, Bulk capacity, Submerged density, Angle of repose in dry & wet conditions, Angle of internal friction for different soil layers including at 3 meters depth shall be indicated in the soil investigation report.
4. Present water table and history of variation of water table at the tower locations shall be indicated in the report.
5. Classification of foundation should be indicated based on the water table, Bearing capacity, Swelling Index, Soil type and the value of the angle of repose in line with parameters indicated in the standard foundation drawings.

River Crossings / Special Foundations

1. A sketch indicating profile of river crossing locations with borehole positions shall be indicated in the soil investigation report.
2. Maximum discharge, Maximum velocity and Highest Flood Level (HFL) data of the river shall be enclosed in the soil investigation report.
3. Comprehensive Bore log sheet indicating the depth of different soil strata, soil type, SPT Value & Water table for each bore hole is to be indicated in the soil investigation report.
4. Natural Ground Level (NGL) for all locations are to be indicated, note that the NGL & HFL should be w.r.t same reference level.
5. Whether the river is navigable or not is to be indicated in the report.
6. Silt factor calculation based on the laboratory test results of weight mean diameter of soil for different layers to be furnished in the report.

7. Bulk density, Submerged Density, Value of Cohesion (c) and Angle of internal friction, for different soil layers based on laboratory test results shall be indicated in the soil investigation report.
8. If rock encountered prior to termination of bore hole (40 meters below existing ground level), core drilling should be done, the detail of core recovery (Run wise) and calculation of Rock Quality Designation (RQD) with photograph of core sample properly placed in a core box are to be enclosed in the soil investigation report.
9. If the refusal is not obtained or the type of soil encountered at the depth below existing ground level is very poor like loose clay, organic deposit etc. further boring should be furnished in the soil investigation report as detailed above.

SITE ORDER

[illegible]

HINDRANCE

[illegible]

PIT MARKING

Name of Line / Site:

Location No.....

Tower Type.....

1. Approved Drawing No.

.....

2. Reference Level

.....

3. Alignment of location w.r.t previous and next Location

.....

4. Centre of location / position of various landmarks

.....
are matching with profile.

5. Any new object on ground w.r.t profile necessitating YES /
NO re-alignment / shifting of location features or due to any other
reasons

6. Span on both sides of Location

As per profile / As per
Actual (Mtrs)
(Mtrs)

a) Preceding Span (Loc. No.)

..... /

b) Succeeding Span (Loc. No.)

..... /

7. Angle of deviation and bisection (for Angle tower locations) As per profile /

As per Actual a) Angle of Deviation

..... /

.....

b) Bisection Details

..... /

8. Position of cross pegs in transverse direction

O.K / Not O.K

9. Position of all four pits are as per profile / safe

Yes / No

10. Dimension of pits are as per drawings

Yes / No

11. Whether Benching / Revetment required if yes

a) If contour maps / approved revetment drawings available / prepared

Yes / No

b) Possibly calculated volume Cu. M

Certified that location is cleared and safe for excavation

Representative of Contractor

.....

Representative of Consultant

.....

Representative of HPSEBL

.....

STUB SETTING

Name of Line / Site:

.....

Location	No.	Tower	Type.
.....		

1. Approved Drg. No.

.....
.....

2. Pit Dimensions

a) Depth of Pits	From Ref. Level	Ground Level
------------------	-----------------	--------------

PIT A	-----	-----
-------	-------	-------

PIT B	-----	-----
-------	-------	-------

PIT C	-----	-----
-------	-------	-------

PITD	-----	-----
------	-------	-------

-

b) Pit dimensions are as per approved foundation classification	Yes / No
---	----------

c) Excavated soil is kept minimum 2 meter away from pit edge	Yes / No
--	----------

d) Under cutting is done in case of fissured rock as per approved drawing	Yes / No
---	----------

e) Minimum working space of 50 - 80 mm is kept for ease of reinforcement / form work Except in case of fissured rock foundation	Yes / No
--	----------

3. Whether make use of Template or Prop for casting of foundation -----

In case of template

a) Alignment of template

Tangent tower (in the direction of line)	Yes / No
--	----------

b) Angle tower

Angle of Deviation	-----
--------------------	-------

Alignment of template on bisection	Ok / Not Ok
------------------------------------	-------------

4. Diagonal of Template

AC

BD

Representative of Contractor

Representative of Consultant

Representative of HPSEBL

CONSTRUCTION MATERIAL

Name of Line / Site:

.....

Location No..... Tower Type.....

Classification.....

1. Quality & Quantity of Coarse Aggregate and Fine Aggregate

Material Detail	Qty. Required	Qty. Available	Approved Source	Quality
Fine Aggregate				
20 mm CA				
40 mm CA				

2. Dimension of Measurement Boxes (30 cm x 30 cm x 39 cm)

OK / Not OK

3. Proportion of Nominal Mix

Grade of Concrete	Qty. of Cement	Qty. of Fine Aggregate	Qty. of Coarse Aggregate	Qty. of Water
M10				
M20				

4. Quality & Quantity as per specification

5. Reinforcement Steel

Dia of Bar	Qty. Required (MT)	Qty. Available (MT)	Approved Source	Quality (OK/Not OK)
6 mm				
8 mm				
12 mm				
16 mm				
20 mm				
25 mm				

6. Form Boxes

a) Dimensions are as per approved drawings

OK/Not OK

b) Oiling of inner walls of Form Boxes

OK/Not OK

7. T&P and Man power as per requirement are available at site

OK/Not OK

8. Lean Concreting/PCC-M10

a) Pits are free from are foreign material

Yes/No

b) Pits are free from standing water (Dewatering continued in advance NoPumps / Buckets)

Yes/

c) Mix ratio 1:3:6 with 20 mm coarse aggregate

Yes/No

d) Concrete mixture by mixer as per specification

OK/Not OK

e) Mixture running time (minimum 2 minutes)

OK/Not OK

f) De-Watering done

Yes / No / Not

Required

g) Lean concreting is done up to specified level and area in all the four pits

Yes / No

h) No of cement bags consumed

As per design /Actual

i) In case of excess excavation filling is done by lean concrete & noloose soil is permitted for filling volume of excess lean concrete

Certified that pits are cleared for installation of reinforcement steel & form boxes

Representative of Contractor

Representative of Consultant

Representative of HPSEBL

INSTALLATION OF REINFORCEMENT STEEL & FORM BOXES

Name of Line /

Site.....

Location No..... Tower Type..... Type of Foundation.....

Approved Drawing

No.....

SL	Description	Acceptability
1	Reinforcement Steel	
a)	Pits are free from stagnant water	Yes / No
b)	De-watering arrangements are available	Yes / No
c)	Bending & Placing is done as per approved drawings and specifications	Yes / No
d)	Required number of chair rods are being used (Min-12 mm dia)	Yes / No
e)	Binding is done as per specification and BBS	Yes / No
f)	Any undue stress or bending of steel bars	Yes / No
g)	Steel being used for reinforcement is of approved make	Yes / No
h)	Steel is clean and free from any rust or foreign material	Yes / No
i)	Position of bars w.r.t stub is as per approved drawing	Yes / No
2	Form Boxes	
a)	Dimensions of form boxes are as per approved drawing	Yes / No
b)	Bolts and Nuts are water tightened	Yes / No
c)	Shuttering oil / Mobil oil is applied to inner faces of form boxes	Yes / No
d)	Form boxes are placed w.r.t stub as per approved drawing	Yes / No
3	Clear cover of 50 mm or as per drawing is available	Yes / No
4	Earthing Strip is fixed as per approved drawings	Yes / No
		Yes / No

Certify that installation of reinforcement steel is ready for casting / concreting.

Representative of Contractor

Representative of Consultant

Representative of HPSEBL

POUR CARD

Name of Line /
Site.....

Pour Card No.....

Date.....

Location No.....

Reference Drawing
No.....

S. No.	Items	Status / Remarks
1	Mix proportion as per specifications	
2	Quantity of concreting as per approved drawing	
3	Level of stub & chimney concreting	
4	Checking for shuttering & shoring	
5	Reinforcement as per BBS & specifications	
6	Slope of stub as per approved drawing	
7	Checking for stub nut-bolts, cleat-plates etc.	
8	Cement Brand & Week No	
9	Quantity of cement	
10	a) As per design	
11	b) As per actual	
12	Water cement ratio	
13	Slump value	
14	Identification of Cubes	

Certified that prepared mix / concrete is as per specifications and ready to pour

Representative of Contractor

Representative of Consultant

Representative of HPSEBL

MIXING, PLACING AND COMPACTION OF CONCRETE

Name of Line /

Site.....

Location No.....Type of Tower Classification of

Foundation.....

Approved Drawing No.....

S. No.	Description	Acceptability
1	Mix Ratio	
a)	For Frustum & step boxes with M20 (1:1.5:3), use of 40 mm coarse aggregate	Yes / No
b)	For Chimney with M20 (1:1.5:3), use of 20 mm coarse aggregate	Yes / No
c)	Water cement ratio as per specification	Yes / No
2	Mixing method	
a)	Concrete mixer machine (minimum running time: 2 Minutes)	Yes / No
b)	Hand Mixing (use of 10 % extra cement) , only for inaccessible location	Yes / No
c)	Hand mixing done on either GI sheet or pucca floor	Yes / No
3	Use of poking rod for compaction of concrete	Yes / No
4	Use of vibrator for compaction of concrete	Yes / No
5	Casting of frustum & chimney in continuity	Yes / No
6	Quantity of cement as per specification	Yes / No
7	Coping is done as per approved drawing	Yes / No
8	Detail of Cube Preparation	
	Tower Legs	Date of Casting
	A	
	B	
	C	
	D	
9	Removal of shuttering after 24 hours of concreting	Yes / No
10	Layer wise backfilling of soil along with water for curing	Yes / No
11	Curing is done for minimum 10 days	Yes / No
12	Use of wet gunny bags for curing of chimneys	Yes / No
13	Availability of water pump & storage arrangement for curing	Yes / No
14	Backfilling & levelling of foundation as per specification	Yes / No
15	Removal of surplus material from site	Yes / No
16	Cubes are kept in water for curing (28 Days)	Yes / No

Certificate: Foundation is cleared for tower erection subject to fulfilment of part-I before erection and part-II in due course of time and planning.

Part-I: Setting period (28 days) is allowed as per specification

Part-II: a) Revetment / Benching proposal if any

.....

b) Revetment / Benching likely execution

.....

Representative of Contractor

Representative of Consultant

Representative of HPSEBL

JOINT MEASUREMENT CERTIFICATE (FOUNDATION WORKS)

Name of line / site						
Tender No. & Date						
Contractor's Name						
JMC No.					Date:	
Location No.					Type of Tower:	
Foundation Drawing No.					Depth of water Level:	
Stub Drawing No.					Foundation Classification:	
1. Excavation Detail						
a) Area of Pit		Length =	Breadth =		Area =	
PIT DETAIL	Type of Soil & Depth Detail in Meters					
	Dry	Wet	PS	DFR	WFR	Hard Rock
PIT A						
PIT B						
PIT C						
PIT D						
Average Depth (D)						
Volume = AXD						
Under Cut Volume in FR						
Total Volume						

2. DETAIL OF BENCHING (If any)

- a) Proposal of benching submitted Yes / No
- b) Approval of contour drawings & benching proposal Yes / No
- c) Volume of benching done.....Cubic Meter

3. DETAIL OF DE-WATERING (If any)

- a) Whether de-watering is done during concreting works Yes /
 No If done then mode of de-watering
- b) Manual.....Man Days
- c) Mechanical Pump.....Hours
- d) Power Driven PumpHours

4. CHECKING OF CASTING

- a) Alignment of location & template Found Ok / Not Ok
- b) Diagonal (In Meters) AC = , BD =
- c) Level of stub & template Found Ok / Not Ok
- d) Quality of
- i) Coarse Aggregate Found Ok / Not Ok, (Source Name)
- ii) Fine Aggregate Found Ok / Not Ok, (Source Name)
- iii) Cement Found Ok / Not Ok, (Make / Type)
- iv) Reinforcement Steel Found in order / Not in order, (Make.....)
- v) Water Clean & Potable Water / Not Ok, (Source Name)

5. DETAIL OF CONCRETING WORKS

- a) Volume of Concrete (1:1.5:3, M20)Cubic Meter
b) Volume of Concrete (1:3:6, M10)Cubic Meter
c) Quantity of cement bags consumed in M20 concreteNos
d) Quantity of cement bags consumed in M10 Concrete Nos
e) Total cement bags consumed in entire casting of foundation (M10 + M20) ..Nos
f) Quantity of Reinforcement placed as per drawing Yes / No

Reinforcement Steel			Sub Detail		
Size of Bar	Quantity	Unit	Item of Stub	Quantity	Unit
06 mm		Kg	Mild Steel		Kg
08 mm		Kg	HT Steel		Kg
10 mm		Kg	Bolt & Nut including washers		Kg
12 mm		Kg			
16 mm		Kg			
20 mm		Kg			
25 mm		Kg			
Total Weight		Kg	Total Weight		Kg

6. Detail of Revetment / Protection Wall (If any)

- a) Proposal of Revetment Submitted along with drawing & justification Yes / No
b) Approval of Revetment Proposal Yes / No
c) Volume of excavation Cubic Meters
d) Cement Concrete, 1:4:8 (If Any)Cubic Meters
e) Plain Cement Concrete, 1:3:6 (If any) Cubic Meters
d) RCC & Coping with M15Cubic Meter
f) RR Masonry Works (1:6)Cubic Meters
g) Steel for Reinforcement Kg
h) Dry Stone Masonry (If any) Cubic Meter
i) Stone Packing in Weep Holes..... Cubic Meter

7. Detail of Cubes

- a)No. of cubes prepared along with dates
b)Current status of cubes whether under curing or sent to lab for testing or tested
c)Copy of cube test report from approved lab (if tested) Yes

/ No Certify that work has been carried out as per specifications & approved

design/drawings. **Representative of Contractor**

Representative of Consultant

Representative of HPSEBL

CHECK LIST OF TOWER ERECTION WORKS

Name of Site /

Line.....

Location No..... Tower

Type.....

S. No.	ITEM DESCRIPTION	STATUS	OBSERVATION
1	Backfilling, compaction and levelling of foundation is as per specification and location is ready for tower erection works	YES / NO	
2	Setting period of foundation is allowed for at least 14 days as per specification.		
3	All tested tools, plants and safety equipments are in working conditions.		
4	Revetment / protection wall if any is completed if not then program of completion.		
5	Shut down of power lines if required is arranged.		
6	PPE's Safety shoes, Helmets, Safety Belts are being used.		
7	Double lanyard full body harness is being used.		
8	First section of tower is braced and all plan diagonals are placed in proper position.		
9	Guying of tower provided as per approved drawings and norms, guying of tower to be terminated on firm ground.		
10	All nut-bolts, flat / spring washers are provided as per approved drawings.		
11	All vertical bolts to be kept downward and horizontal to be kept outside the tower.		
12	Subsequent sections of tower are erected only after complete erection and bracing of previous section.		
13	Any undue stress, bending or damaged of member during erection noticed.		
14	Any filling of holes or cutting of members during erection works		
15	Any heavy hammering of bolt causing damage of threads noticed.		
16	Any substitute of tower members erected, if yes member nos.		
17	Tightening is done progressively from top to bottom.		
18	All bolts at same level are tightened simultaneously		
19	Slipping /running over nut bolts are replaced by new ones		
20	Threaded portion of bolts projected outside of nut is not less than 3 mm.		
21	Punching of threads projected outside is done at three positions on diameter.		
22	All blank holes are filled with correct size of bolt-nut.		
23	Verticality of tower is checked with help of theodolite for both longitudinal and transverse directions, this is within specified limit.		

S. No.	ITEM DESCRIPTION	STATUS	OBSERVATION
24	Detail of missing members, nut-bolts.	YES / NO	
25	Tack welding is done as per specification using standard quality of welding rods.		
26	Zinc rich paint applied on tack welding.	Yes/ No	
27	Earthing		
a)	Tower footing resistance (Value in Ohms)		
b)	Soil Resistivity (Value in Ohm-M)		
	Type of Earthing Done	Pipe Type / Counter poise earthing type	
A	Pipe Type Earthing		
1	Earthing provided on leg A	Yes/ No	
2	G.S Pipe, flat tightened with nut & bolts and placed as per approved drawings	Yes/ No	
3	There is no sharp damage or bent in earthing strips /flat	Yes/ No	
4	Finely broken coke and salt in ratio of 10:1 is filled in earth pits (Alternate Layers)	Yes/ No	
5	Backfilling done properly	Yes/ No	
B	Counter Poise Earthing		
1	Excavation is done up to required depth of 1 meter and length of 15/30 meters in four radial direction	Yes/ No	
2	GS wire placed in excavation and lugs firmly tightened with nut-bolts.	Yes/ No	
3	Backfilling is done as per specification	Yes/ No	
C	Value of tower footing resistance after earthing in dry season (Permissible limit of 10 Ohms)	----- Ohms	

Certificate: Certify that erection of tower is completed in all respect and footing resistance is within permissible limit.

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JOINT MEASUREMENT CERTIFICATE

(Tower Erection)

Name of Line / Site:

.....

Location No.....

Tower

Type.....

Date of Completion.....

Tower Type	Summary of Weight in MT				
	H T	MS (Incl. PW & Accessories)	Hex. Bolts & Accessories	Total	BOM Ref. No.

Status of Tack welding

Status of application of anti-corrosive paint.....

Status of fixation of tower accessories.....

Certificate: Work is executed as per specification and approved drawing

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JOINT MEASUREMENT CERTIFICATE CUM CHECK LIST (Earthing Works)

[illegible]

Certificate: Certify that work is carried out as per approved drawings / technical specification and following conditions are met.

1. Quality and quantity of salt & coke is as per approved drawings in case of pipe earthing.
(Yes / No)
2. Nut-Bolts / Washers are properly tightened (Yes / No)
3. Specification & Size of Bore Pipe and MS Flats are per approved drawings..... (Yes/No)
4. Depth of bore pipe is 3 meters..... (Yes/ No), If no specify the reason in observation column
5. Length & depth of counter poise wire to be mentioned in observation column.
6. Value of soil resistivity to be mentioned in observation column in case of counter poise earthing.
7. Specification & Size of GS wire, MS lugs, nut-bolts & washers are as per approved drawing in case of Counter poise earthing (Yes/No).

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JOINT MEASUREMENT CERTIFICATE

(Stringing Works)

Name of Site / Line

.....

Tender No. & Date

.....

S. No.	Section Detail			Observations if any
	From (Tower. No.)	To (Tower No.)	Section Length (Mtrs.)	
Total length of sections in Km				

Certified that stringing is done as per approved sag chart/ specifications and following conditions are met during stringing works.

1. Stringing is carried out in above mentioned sections as per approved stringing chart, drawings and technical specifications.
2. Work has been completed in all respect including Final sagging, Installation of OPGW/Earthwire, Jumpers, Pilot Strings, Spacers, Vibration Dampers, MSJ, CC Rings, Copper Bonds, Junction boxes etc.
3. All safety rules and regulations are being followed at site such as use of PPEs, proper earthing, shut down of feeders / power lines (if required), prohibition of unauthorised person and general public in corridor, correct methodology of pulling/lifting/ paying out / sagging etc.
4. Periodic & proper maintenance and overhauling of tools, plants, machineries etc.
5. All sections and locations are made clean & free from any kind of scrap, debris which may cause potential impact on environment etc.
6. No damaged conductor, earth wire, insulator, hardware fittings and accessories are being used in any span / section being billed.
7. Workmanship and quality of execution as per relevant specification and methodology.

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CHECK LIST FOR STRINGING WORK

Name of Site / Line

.....

Section Length.....From AP. No.To AP. No.

ITEM CHECKED/RESULT		OBSERVATION,IF ANY
A)	Pre- Stringing Checks:	
1)	Back filling of soil and revetment/ Benching Wherever required is done.	Yes/ No
2)	Towers are tightened properly and all the Members, Nut/Bolts are provided.	Yes/ No
3)	Trees in the corridor removed to facilitate Smooth stringing.	Yes/ No
4)	All line materials, tested T&P, safety equipments and relevant drawings available for stringing.	Yes/ No
5)	Shutdown of Power line/Railway block if Required, is arranged.	Yes/ No
6)	Necessary protection/ Scaffolding/warning Signals provided for Railway/Power line/P&T Line/Road Crossings.	Yes/ No
7)	Towers vulnerable for one side load are guyed Properly.	Yes/ No
8)	Tower footing resistance is within permissible Limit of 10 ohms.	Yes/ No
B)	Paying out of OPGW / Earthwire: -	
1)	Work is being carried out in full safety measures as per guide line.	Yes/ No
2)	Traveling rounds are provided.	Yes/ No
3)	Paying out is carried out as per approved Drum schedule.	Yes/ No
4)	All pulleys fixed on towers for paying out are moving freely.	Yes/ No
5)	Effective communication exists through walkie-talkie and through persons on towers.	Yes/ No
6)	Earthwire /OPGW is being constantly checked as it is unwound, damaged portion, if any, is removed	Yes/ No
7)	Necessary arrangements have been provided to avoid rubbing of Earthwire / OPGW against hard ground / surface	Yes/ No
8)	Necessary details of OPGW/Earthwire, M.S. Joints Junction boxes recorded as per Annexure CF-I & CF-II.	Yes/ No

C)	Paying out of conductor	
1)	Work is being carried out with full safety measures as per guideline.	Yes/ No
2)	Tensioner/ Puller/Winch Machine are properly placed, Firmly anchored and earthed.	Yes/ No
3)	Conductor drums are placed properly to avoid bird caging.	Yes/ No
4)	Sequence of paying out is such that to avoid unbalancing of load on tower.	Yes/ No
5)	Details of insulators and fitting are recorded as per Annexure CF-III & CF-IV.	Yes/ No
6)	Paying out is carried out as per approved drum schedule.	Yes/ No
7)	Travelers fixed on towers are moving freely	Yes/ No
8)	Effective communication exists through Walkie-talkie and through persons standing at towers for smooth and safe paying out.	Yes/ No
9)	Conductor is checked continuously as it is unwound from drum, damaged portion, If any, is removed/ repaired.	Yes/ No
10)	Proper arrangements made to avoid rubbing Of conductor on ground/hard surfaces.	Yes/ No
11)	Details of conductor and MSJ/Repair Sleeve is recorded as per Annexure CF-I & CF-II.	Yes/ No
D)	Final Sagging and Tensioning of Earth Wire / OPGW and Conductor	
1)	Sag board is fixed correctly after taking into account length of suspension clamp/fittings	Yes/ No
2)	No. of sag boards fixed in a section is as per technical specification.	Yes/ No
3)	Sag is measured correctly at prevailing Temperature, details recorded as per Annexure CF-V.	Yes/ No
4)	Sag mismatch is within permissible limits and checked with theodolite	Yes/ No
5)	After measuring sag, marking/cutting of Earthwire/conductor is done correctly to fix tension clamps/ fittings.	Yes/ No
6)	Details of tension clamps/fittings are recorded as per annexure CF-VI, CF-III & CF-IV.	Yes/ No
E)	Clipping of Earthwire / OPGW and Conductor	
1)	For Clipping, the marking is done correctly so That suspension clamp/fitting hangs exactly vertical.	Yes/ No
2)	Before clipping of conductor, proper earthing is provided.	Yes/ No
3)	Following line material provided as per Specification, details recorded as shown below. a) Suspension clamp of Earthwire/ OPGW and Conductor as per annexure CF-IV & CF-VI.	Yes/ No

	b) Vibration dampers for Earthwire/ OPGW and Conductor as per annexure CF-VII. c) Spacer/Spacer damper/ jumper spacer as per annexure CF-VIII. d) Jumper for Earthwire / OPGW/ conductor as per annexure CF-IV & CF-VI e) Pilot fitting, wherever necessary as per annexure CF-III & CF-IV.	
4)	Sag/tension again measured after clipping and found OK. Details recorded as per annexure CF-V.	Yes/ No
5)	Transportation done as per specification. details of line material recorded properly.	Yes/ No
6)	All line materials provided as per specification and approved drawings, all necessary details are recorded for traceability.	Yes/ No
7)	Jumpers are tightened properly, live metal clearances are as per specification.	Yes/ No
8)	Minimum ground clearance, clearance over Power line/railway line/ river crossing are as per Specification.	Yes/ No

Certificate: Stringing is completed as per relevant specifications in all respect.

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1. Make
2. Batch No
3. Quantity and Location.....

4. There is no damage to Earthwire/ conductor before or during stringing. Strands are in perfect position.

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ANNEXURE CF - II

Details of M.S. Joint for Earthwire/ OPGW/ Conductor & Repair Sleeve for Conductor

1. Make
2. Batch
3. Quantity and Location

S. No.	Between Loc. No.	Phase No.	Wire No.

4. Dimension-Recorded as per Annexure CF –IX
5. M.S. Joint has been provided at least 30 meters away from tower.
6. There is no M.S. Joint over Railway/River/Main Road crossings.
7. Not more than one M.S. Joint provided in one span for each Earthwire/ conductor.
8. Repair sleeve shall be used if number of damaged strands is not more than $1/6^{\text{th}}$ of the total strands in outer layer. If damage is more then the damaged portion shall be removed and M.S. Joint provided.
9. Bores in the sleeves are perfectly clean
10. The following may be checked as per approved drawing.
 - a. Marking and Cutting.
 - b. Correct size of dies.
 - c. Centering & fixing of sleeves.
 - d. Fixing of all the components i.e. Aluminum and pipes, hole plugs etc.
 - e. Compression of sleeves at specified pressure.
 - f. Application of filler paste (Zinc chromate).
11. All the sharp edges have been filled after compression.
12. There is no crack, bend or any damages to joint after compression.

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ANNEXURE CF - III
RECORDS OF INSULATORS

1. Type
2. Make
3. Batch No
4. Electro Mechanical Strength
5. Quantity and Location

S. No.	Loc. No	Qty. as per Specification	RHS	LHS	Remarks

6. Insulators are completely cleaned with soft cloth, glazing is proper, there is no crack, scratch or white spot on its surface.
7. 'R' clips in insulator are fitted properly.
8. While hoisting, no damage caused to insulator.

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ANNEXURE CF - IV
DETAILS OF HARDWARE FITTINGS

1. Make
2. Batch No
3. Type of fitting
4. Quantity and Location

S. No.	Loc No.	Hardware Fittings		Remarks
		RHS	LHS	

5. All nuts/ Bolts properly tightened.
6. All components of fittings have been provided as per approved drawings. Dimensions and galvanizing are OK. Fitting is cleaned and there is no damage to any component.
7. All split /cotter pins properly provided.
8. In case of Tension fittings, dimensions before and after compression recorded as per AnnexureCF-IX.

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ANNEXURE CF - V
SAG MEASUREMENT FOR EARTHWIRE /OPGW AND CONDUCTOR

1. Sag board fixed between
2. Temperature..... °C
3. Measurement of Sag/Tension

Item	RHS /LHS PHASE	As per Sag/ Tension Chart	Actual
Sag			
Tension			

4. During paying out/ rough sagging, tension in conductor/Earthwire/OPGW was as per technical specification.
5. For final sagging, initial stringing chart for conductor and final stringing chart for earth wire/OPGW are used.

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ANNEXURE CF - VI
SUSPENSION & TENSION CLAMPS FOR EARTHWIRE /OPGW

1. Make
2. Batch No
3. Quantity and Location No

S. No.	Phase No. / Wire No.	Loc No.	Remarks

4. All components of clamps have been provided as per approved drawings, dimensions and galvanizing is OK, clamp is cleaned and there is no damage to any component.
5. All nuts & bolts have been properly tightened.
6. Split / cotter pins have been properly fixed.
7. In case of tension clamp, dimensions before and after compression recorded as per AnnexureCF- IX.

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1. Make
2. Batch No
3. Quantity and Location No

S. No.	Fixed on Loc. No.	Fixed towards Loc. No.	Phase / wire No.	No. of V.D.

4. All components of V.D. have been provided as per approved drawings, dimensions and galvanizing are OK. V.D. is cleaned and there is no damage to any component.
5. All nuts & bolts have been properly tightened.
6. V.D. fixed as per approved placement chart.

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3. Quantity and Location No

S. No.	Span/Loc No.	Pole No.	No. of Spacer

5. All nuts & bolts have been properly tightened.

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CHAPTER- 15: FIELD QUALITY PLAN SUB STATION

STANDARD FIELD QUALITY PLAN FOR POWER TRANSFORMER

S.No.	CHARACTERISTICS/ ITEMS	INSTRUMENT	TYPE OF CHECK	QUANTUM / FREQUENCY OF CHECK	REF. DOC & ACCEPTANCE STANDARD	Responsible agencies		FORMAT OF RECORDS	REMARK
						Contractor	Employer		
1	RECEIPT AND STORAGE								
1.1	RECEIPT OF MATERIALS								
1.11	Check for Manufacturer's name as per Purchase Order, Name Plate details / Delivery Challan.		Visual	100%	Delivery Challan & Packing List / Transformer Name Plate	Verify	Verify		
1.12	Review Reports (Completeness of documents etc.)		Visual	100%		Verify	Verify		
1.13	Check supply of accessories / Loose supply items (if any)		Visual	100%	Packing List / BOQ	Verify	Verify		If short supplied Yes, Report immediately to Project Manager
1.14	Visual examination for damage / oil Leakage		Visual	100%	With out damages & leakages	Verify	Verify		If Yes, Report immediately to Project Manager

1.2	STORAGE OF MATERIALS								
1.21	Ensure that different accessories / loose supply material are stored separately section and size wise labeled and tagged for easy identification		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
1.22	Ensure that all hardware are tagged & kept separately in racks/Bags size-wise for easy identification		Visual	do	do	Verify			
1.23	Ensure Gasket shell be stored in room.					Verify			
1.24	Ensure Tarpaulin covers have been provided.		Visual	do	do	Verify			
1.25	Ensure that area where the transformer oil drums are stored is free from fire hazards.		Visual	100%	do	Verify			
1.26	Ensure crates should not be stacked one over the other.		Visual	do	do	Verify			
1.27	Ensure surrounding area of storage is not polluted and water does not accumulate in the storage area.		Visual	do	do	Verify			
1.28	Ensure that the material is stored in vertical position or vertically raised wooden platform/ Planks to avoid direct contact with ground / Moisture .		Visual	do	do	Verify			
1.29	Ensure that the material is stored in systematic manner rating wise for easy removal/ Usage.		Visual	do	do	Verify			
1.3	Ensure sufficient space is provided underneath for free flow of air and also for lifting, jacking etc..		Visual	do	do	Verify			

1.31	Ensure in case of gas filled storage the dry nitrogen gas cylinder shall be available of manufacturer specification.		Visual	do	do	Verify			
1.32	Ensure if the pressure of gas inside the tank in case of gas filled storage drops due to leakage, the leakage point should be detected by using soap water. The matter shall be reported to the manufacturer for immediate action.		Visual	do	do	Verify			Report immediately to Project Manager
1.33	Ensure that, if the oil leakage is present in transformer tank while received and it is not possible to rectify the leak immediately , the transformer must be made as water tight as possible by putting a tarpaulin sheet over the whole tank until remedial measures can be carried out.		Visual	do	do	Verify			Report immediately to Project Manager
2.00	PRE-INSTALLATION								
2.01	Check name plate details of the transformer with drawing.		Visual	do	GA Drawing	Verify			
2.02	Check size & type of hardware / accessories required as per the drawing / BOQ.		Visual	do	GA Drawing/ Packing List	Verify	Witness		
2.03	Ensure that no physical damage to trafo body / bushing etc. is observed.		Visual	do	No damages	Verify	Witness		
2.04	Ensure that no oil leakage is observed, oil level is OK and drain / sampling valves is tightly dosed.		Visual	do	No leakages	Verify	Witness		
2.05	Check Matching of rails / wheels of trafo, and mounting foundation.		Visual	do	GA Drawing	Verify	Witness		

2.06	Handling Tools: crane Capacit 5 to 10T sling and shackles for lifting ,Pulling Winches/Pulleys, Hydraulic / Mechanical Screw Jacks with locking facility ,Wooden Sleepers, Measuring Tape, Spirit Level/Level tube(Plastic).Oil storage tank of sufficient capacity,Oil Purifier, Flexible hoses, Water proof\ sheets,Venyl Hose, Hose Nipple, CTC,Rag cotton cloth, Unstarched Mill Cloth, Knife etc. Electrical Tools: Megger 5KV,2KV,500V,Multimeter,Electric Hand Lamp, Oil testing equipment etc.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
2.07	Ensure that foundation for mounting the transformer has been rigidly constructed with wheel stopper etc.		Visual	do	Foundation civil drg.	Verify	Witness		
2.08	Ensure the dragging passage and movement area of transformer tank is clear from any free movement obstructions.		Visual	do	–	Verify			
3.00	INSTALLATION								
3.01	Ensure while unloading from the Trailer/ Waggon lift the main body of the transformer with Jacks, slipper and winches. Each Jacks capacity may be rated for approximately 50% weight of transformer with oil. DO NOT APPLY ANY DIRECT HORIZONTAL PUSHING LOAD TO TRANSFORMER TANK.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.02	Ensure unloading must be done without any jerking movements or dropping.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.03	Ensure use only slinging hooks/ bollards for lifting.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			

3.04	Ensure if the foundation of the transformer is not ready and if the transformer is to be unloaded temporarily, it should be done on a leveled hard surface/ wooden slippers preferably , under base of the transformer, should not rest on the ground.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.05	Ensure that 300 to 400 mm wooden sleepers to facilitate jacking.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify	Witness		
3.06	Ensure when jacking (e.g. to remove steel plates), position the jacks under specified jacking pads only. When jacking, ensure that all four jacks are operated simultaneously.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.07	Ensure if the transformer is not provided with rollers and if it is to be erected on its skid base, the transformer must be slid to its final position using greased steel plates.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.08	Ensure before lowering, clean all grease dirt etc. from the under base of the transformer.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.09	Check that transformer rests securely on foundation and wheels are anchored and welding of stoppers to rails.		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.10	Check and ensure that level of all the foundations for cooler support are in the same level as that of the top surface of rails. Level difference should be compensated by putting shims if the level is lower and chipping the concrete foundation if the level is higher.		Measurement	do	Manufacturer Manual/Drawing	Verify			

3.11	Ensure cooler Assembly should be carried out referring to "GENERAL ARRANGEMENT" and "PART MARKING DRAWING" of the transformer.		Visual	do	Manufacturer Manual /Drawing	Verify			
3.12	Ensure all items of pipe work are match marked.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.13	Ensure that all accessories belong to the same unit. Indent No., Unit No. and Serial number		Visual	do	Manufacturer Manual/Drawing	Verify			
3.14	Ensure all joints are to be assembled with gasket only and without using compound or grease.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.15	Check Top and bottom butterfly valves of each radiator should be in the same vertical line. This should be confirmed by a plumb.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.16	Check and ensure while mounting oil pump and oil flow indicators, care should be taken to ensure that arrows indicating oil flow direction are towards the transformer tank.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.17	Check and ensure the mounting of the conservator as shown in G.A. drawing.		Visual	do	G.A. Drawing	Verify			
3.18	Check and ensure the mounting of all valves as shown in GA drawing on the conservator		Visual	do	G.A. Drawing	Verify			
3.19	Check and mount the Air cell in conservator as per Manufacturer Manual instruction.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.20	Ensure direction of Buchholz Relay by the direction of arrow on Buchholz Relay towards conservator.		Visual	do	G.A. Drawing	Verify			

3.21	Ensure the mounting of silica gel breathers for main and OLTC conservators.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.22	Check and Mount PRD as per manufacturers leaflet and also the G.A. drawing of Transformer.		Visual	do	G.A. Drawing	Verify			
3.23	Ensure turret installation (w.r.t match mark & orientation) prior to bushing installation.		Visual	do	G.A. Drawing/Matching Mark.	Verify			
3.24	Ensure before starting the erection work of Condenser Bushing, lift the Bushing from its crate and keep it vertical and check the oil level. Confirm that oil level is upto the centre of oil sight window of Bushing		Visual	do	Manufacturer Manual/Drawing	Verify			
3.25	Ensure if weather is bad (rain, snow or fog) the tank should not be opened unless adequate shelter is provided.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.26	Ensure for details of connections from winding to the bushing refer to the specific drawing and suppliers catalogue given in the instruction manual.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.27	Ensure that a fresh gasket is used while mounting the bushing		Visual	do	Manufacturer Manual/Drawing	Verify			
3.28	Ensure that the air release pipe connections are oriented towards the correct directions, as shown in the GA and part marking drawings.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.29	Ensure while mounting the bushings, ensure that the oil level gauge is oriented away from the transformer.		Visual	do	Manufacturer Manual/Drawing	Verify			

3.30	Check and ensure that secondary terminals of turret mounted C.T. if any, are connected to the proper terminals on the terminal board.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.31	Check before mounting the thermal sensing bulbs, inside of the pocket should be cleaned thoroughly and filled with transformer oil upto a depth of half the pocket.		Visual	do	G.A. Drawing	Verify			
3.32	Ensure Capillary tubes should be clamped properly.		Visual	do	G.A. Drawing	Verify			
3.33	Ensure that a minimum capacity of oil filltation machine should be of 6000 litres per hour .		Visual	do	Standard engg. Practice/Supplier Recommendation	Verify			
3.34	Before oil filtration that Check and ensure bottom filter valve shall be attached to inlet point of filter machine and top filter valve of transformer shall be attached to outlet of vacuum filter machine.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.35	Ensure quality of transformer oil must be checked before it is filled into the transformer.		Visual	do	Sepcs / IS.	Verify			
3.36	Ensure Oil samples should be taken from 5 drums at random. Samples should be collected from the bottom of the drums.		Visual	do	Sepcs/ IS.	Verify	Witness		
3.37	Check Oil should be tested for breakdown voltage .		Measurement	do	Sepcs/ IS.	Verify			
3.38	Ensure if oil does not meet the specified criteria, oil should be filtered and stored in the oil storage tank before filling in to the transformer.		Visual	do	Manufacturer Manual/Drawing	Verify			

3.39	Ensure the bottom filter valve is open on the transformer and top air release valve is open on the oil storage tank.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.40	Ensure the filter outlet temperature should be limited to 60-70 °C.		Visual	do	Manufacturer Manual	Verify			
3.41	Ensure Oil level shall be continuously monitored during oil filling.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.42	Ensure results of oil tests and insulation resistance together with the temperatures at the time of measurement should also be recorded in the log sheet.		Visual	do	Specs/Standard engineering practice	Verify			
3.43	Check all air release plugs shall be loosened and closed after releasing trapped air if any.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.44	Check for mechanical stops of OLTC at extreme positions by manually operating with the handle.		Visual	do	Manufacturer Manual/Drawing	Verify	Witness		
3.45	Check raise/lower operations, if direction is correct, check electrical end stops at extreme positions.		Operational	do	Manufacturer Manual/Drawing	Verify	Witness		
3.46	Ensure coupling up of drive mechanism and OLTC bevel gear shall be done only after ensuring that the DM and the tap changer are at the same tap position.		Visual	do	G.A. Drawing	Verify			
3.47	Check and confirm that for each impulse given in both raise and lower directions, diverter switch operation sound is heard before the motor stops.		Operational	do	Manufacturer Manual/Drawing	Verify			
3.48	Ensure that before commencing the test it should be ensured that the secondary terminals of all current transformers are		Visual	do	Standard engineering practice	Verify			

	kept short-circuited. After test these shorting connections shall be removed.								
3.49	Check and confirm tightness of all fasteners.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.50	Check and confirm that valves are either open or closed as indicated the valve schedule plate.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.51	Check all bolted gasket joints and confirm that there is no oil leak.		Visual	do	Standard engineering practice	Verify			
3.52	Check all blanking plates and spares including spare gasket should be stored carefully for future use.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.53	Check all cable terminations and ensure that cables are properly connected and cable numbering ferrules are provided.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.54	Check and ensure that all protective covers like valve guards, LV bushing protection covers etc. are removed.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.55	Check and confirm that all bushing porcelain are cleaned thoroughly and are without damage.		Visual	do	Standard engineering practice	Verify			
3.56	Ensure removal of the cap provided at the bottom of silicagel breather for the transportation purpose.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.57	Check arcing horns if provided are set to the specified gap		Visual	do	Specs/Standard engineering practice	Verify			
3.58	Check all earthing connections are tightened properly.		Visual	do	Specs/Standard engineering practice	Verify			

3.59	Check anti condensation heaters are functioning correctly.		Visual	do	Manufacturer Manual/Drawing	Verify			
3.60	Ensure Rating and connection diagram plates and other marking labels are fitted properly.		Visual	do	Manufacturer Manual/Drawing	Verify			
4.00	TESTING								
4.01	Check and record insulation resistance between pair of windings and windings and earth using 5 kV megger and record.	Megger	Measurement	do	Factory Test Report/Specs	Verify	Witness		
4.02	Check and record the Ratio tests.	Ratio meter /Multimeter	Measurement	do	Factory Test Report/Specs	Verify	Witness		
4.03	Check and record the Vector group tests.	Multimeter	Measurement	do	Factory Test Report/Specs	Verify	Witness		
4.04	Check and record the Magnetic balance test.	Multimeter	Measurement	do	Factory Test Report/Specs	Verify	Witness		
4.05	Check and record the Magnetising current test.	Multimeter	Measurement	do	Factory Test Report/Specs	Verify	Witness		
4.06	Check and record the Winding resistance test.	Micro ohm Meter	Measurement	do	Factory Test Report/Specs	Verify	Witness		
4.07	Check and record the Operation checks of pumps and fans,flow indicators ,circuits for pump.		Visual	do	Factory Test Report/Specs	Verify	Witness		
4.08	Check and record the Operational test Tap changer Equipment,Cooling Equipment	Multimeter	Visual	do	Factory Test Report/Specs	Verify	Witness		
4.09	Check and record the Oil BDV .	BDV Tester/Certified Lab	Measurement	do	Factory Test Report/Specs	Verify	Witness		

4.10	Check and record the CT test of bushing and neutral CT		Current Injection kit	Measurement	do	Factory Test Report/Specs	Verify	Witness		
4.11	Ensure after the inspection and precommissioning tests are successfully completed the transformer can be energized at no load for 24 hrs.			Visual	do	Standard engg. Practice/Supplier Recommendation	Verify	Witness		
4.12	Ensure that after watching the operation of the transformer at no load for 24 hours and confirming that everything is normal the transformer shall be put on load.			Visual	do	Standard engg. Practice/Supplier Recommendation	Verify	Witness		
4.13	Ensure that a joint inspection has been conducted by Client/ contractor / site engineer and a protocol jointly signed by both the parties.			–	do	–	Verify	Witness		
4.14	Ensure that complete site as built drawings / documents along with test reports & reconciliation report have been handed over to Client/Projects/engineering & receipt obtained.			–	do	–	Verify	Witness		
4.15	All test will be done as per technical specification/IS						Verify	Witness		
S.NO.	Revision	Date	Legend	Contractor		Employer				
1										
2										

STANDARD FIELD QUALITY PLAN FOR PT-CVT										
S.NO	TITLE	CHARACTERISTICS/ ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPOSIBE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Transportation documents	Gate pass, Excise duty,MDCC,LA	Visual	100%	Delivery Challan & Spec	Tender specification	Verify	Verify		
	Check the Technical Documents	Check the Availability of Factory test report , catalogues and operation manual	Visual	100%	Delivery Challan & Spec	Tender specification	Verify			
	Physical inspection of material	Check for any physical damage.	Visual	100%			Verify	witness		
		Check name plate details as per P.O	Visual	100%	Purchase order		Verify			
		Verify the case no. as per L.R.	Visual	100%	Manual Standard engg. Practice	Visual	Verify			
2	Qualification of Manpower	Hydra operator should have license	Visual	100%	Certificate	Visual	Verify			
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate	Visual	Verify			
3	Unloding and storage	Extra care to prevent damage on porcelain parts while unloading.	Visual	100%	No damage	Visual	Verify			
		Ensure that equipment is not	Visual	100%	Manual Standard	Visual	verify			

lifted or handled using primary terminals			engg. Practice					
Ensure that the material is stored on raised wooden platform/ Planks to avoid direct contact with ground/ Moisture	Visual	Once in a month.	Manual Standard engg. Practice	Visual	verify	Witness		
Ensure that the material is stored in systematic manner for easy removal / Usage.	Visual	do	do	Visual	verify			
Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification	Visual	do	do	Visual	verify			
Ensure that all hardware are tagged & kept separately in racks/ in Bags size-wise for easy identification	Visual	do	do	Visual	verify			
When stored in unpacked condition, store in such a way	Visual	do	do	Visual	verify			

		that the gauge glass is prevented from possible damage								
4	Pre installation	Check name plate details of the PT-CVT with drawing.	Visual	100%	Drawing / BOQ	Visual	verify			
		Check size & type of hardware / accessories required as per the drawing / BOQ	Visual	do	do	Visual	verify			
		Ensure that no physical damage to PT-CVT body / bushing etc. is observed.	Visual	do	do	Visual	verify	Witness		
		Ensure that no oil leakage is observed, oil level is OK and drain / sampling valves is tightly Closed.	Visual	do		Visual	verify			
		Check Matching of structure / PCD hole on PT-CVT, and mounting foundation	Visual	do	GA Drawings	Visual	verify			
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of In. transformer etc.	Visual	do	Manual Standard engg. Practice	Visual	verify			

		Ensure that foundation for mounting the PT/CVT has been rigidly constructed.	Visual	do	Civil foundation Drg.	Visual	verify	Witness		
5	Installation	Ensure that In.Transformer is always lifted using lifting hooks only and not from bushings etc.	Visual	do	Instruction Manual	Instruction Manual	verify			
		Ensure that the PT/CVT is not tilted during lifting.	Visual	do	do		verify			
		Ensure the orientation of primary and secondary terminals (P1&P2) & secondary terminals.	Visual	do	Manual Standard engg. Practice	Manual Standard engg. Practice	verify			
		Check fixing nuts & bolts are properly tigthed immediately after placement on the structure.	Visual	do	do		verify			
		Check that sender line/vertical line of PT/CVT is correct.	Visual	do	do		verify			
		Ensure fixing of accessories / loose supplied / Terminal Connector items if any.	Visual	do	Packing List		Verify			

		Ensure secondary terminations and earthing connection to earth are done using correct size of lugs / glands / stips/Connectors.	Visual	do	Specs		verify			
		Ensure oil level maintained as recommended.	Visual	do	Manufactures Manual		verify			
		Check verticality / alignment of PT/CVT.	Visual	do	GA Drawing.		verify			
6	Testing	General Checks as mention in check list	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	verify	Witness		
		Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	verify	Witness		
		Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	verify	Witness		

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S.No.	Revision	Date	Legend	Contractor		Employer					
1											
2											
3											

STANDARD FIELD QUALITY PLAN FOR CURRENT TRANSFORMER(CT)										
S. NO.	TITLE	CHARACTERISTICS/ ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
	RECEIPT									
1	Check the transportation documents	Gate pass, Excise duty ,MDCC,LR	Visual	100%	Delivery Challan & Packing List	Availability	Verify	Verify		
	Check the technical documents	Check the availability of Factory test report ,catalogues and operation manual	Visual	100%	Packing List / BOQ	Availability	Verify			
	Physical inspection of material	Check for any physical damage.	Visual	100%			Verify	Witness		
		Check name plate details as per P.O	Visual	100%			Verify			
		Verify the case no. as per L.R.	Visual	100%	No damages & No leakage	No damage	Verify			
2	Qualification of Manpower	Hydra operator should have valid license.	Visual	100%	Certificate		Verify			
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate		Verify			
3	Unloading and storage	Ensure extra care to prevent damage on porcelain parts while unloading	Visual	100%	do		Verify			

		Ensure that equipment is not lifted or handled using primary terminals	Visual	100%	do		Verify			
		Ensure that the material is stored on raised wooden platform/ Planks to avoid direct contact with ground / Moisture.	Visual	Once in a month	Packing List / BOQ	Packing List / BOQ	Verify			
		Ensure that the material is stored in systematic manner for easy removal / Usage.	Visual	100%	do		Verify			
		Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification	Visual	100%	do		Verify			
		Ensure that all hardware are tagged & kept separately in racks/ in Bags size-wise for easy identification	Visual	100%	do		Verify			
		Ensure Tarpaulin covers have been provided if required .	Visual	100%	do		Verify			
		When stored in unpacked condition, store in such a way that the gauge glass is prevented from possible damage	Visual	100%	do		Verify			

4	Pre Installation	Check Matching of structure / PCD hole on CT, and mounting foundation	Visual	do	GA Drawings		Verify			
		Ensure that foundation for mounting the CT has been rigidly constructed.	Visual	do	Civil foundation Drg.		Verify			
		Check size & type of hardware / accessories required as per the drawing / BOQ	Visual	do	do		Verify			
		Ensure that no physical damage to CT body / bushing/bellows etc. is observed.	Visual	do	No Damages.		Witness	Witness		
		Ensure that no oil leakage is observed, oil level is OK and drain / sampling valves is tightly Closed.	Visual	do	Manufacture s Manual		Witness			
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of In. transformer etc.	Visual	do	Manufacture s Manual		Verify			
5	Installation	Ensure that Current Transformer is always lifted using lifting hooks only and not from bushings etc.	Visual	do	Instruction Manual		Verify			
		Ensure that the CT is not tilted during lifting.	Visual	do	do		Verify			

		Ensure the orientation of primary and secondary terminals (P1&P2) & secondary terminals.	Visual	do	Erection Drawing		Verify			
		Check fixing nuts & bolts are properly tightened immediately after placement on the structure.	Visual	do	Manufacture s Manual		Verify			
		Check that center line/vertical line of CT is correct.	Visual	do	do		Verify			
		Ensure fixing of accessories / loose supplied / Terminal Connector items if any.	Visual	do	Packing List		Verify			
		Ensure secondary terminations and earthing connection to earth are done using correct size of lugs / glands / stips/Connectors.	Visual	do	Specs		Verify			
		Ensure that touch up paint has been applied where ever peeled off.	Visual	do			Verify			
		Ensure oil level maintained as recommended.	Visual	do	Manufacture s Manual		Verify			
		Ensure unused secondary cores, if any, have been shorted.	Visual	do	Manufacture s Manual		Verify			

6	Testing		General Checks as per STR	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Witness	Witness		
			Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Witness	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Witness	Witness		
S.No	Revision	Date	Legend	Sub Contractor			Client				
1											
2											

STANDARD FIELD QUALITY PLAN FOR ISOLATOR

Standard Field Quality Plan for ISOLATOR

S.NO	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCY			FORMAT OF RECORDS	REMARKS
							Contractor	Consultant	Employer		
1	RECEIPT										
	Check the transportation documents	Gate pass, Excise duty doc ,MDCC,LR etc.	Visual	100%	Delivery Challan & MDCC	Delivery Challan & MDCC	Verify	Witness	Verify		
	Verify the technical Documents	Check the availability of Factory test report ,catalogues and operation manual.	Visual	100%	Delivery Challan & MDCC	Delivery Challan & MDCC	Verify	Witness			
	Physical inspection of material;	Check supply of accessories like tandem pipes / Insulators / Mechanism box / fixing hardware / any connectors etc. as applicable.	Visual	100%	Packing list/BOQ	Packing list/BOQ	Verify	Witness			
		Visual examination for damage.	Visual	100%	No Damages	No Damages	Verify	Witness	Witness		
2	Qualification of Man power	Hydra operator should have license.	100%	100%	Certificate		Verify	Verify			
		Fitter and Technician should be have relevant experience.	100%	100%	Certificate		Verify	Verify			

3	Unloading and Storage	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction Manual / Standard engg. Practice	Instruction Manual / Standard engg. Practice	Verify	Witness			
		Ensure that the material is stored in a systematic manner rating wise for easy removal & Tarpaulin cover is to be provided when kept exposed if required .	Visual	100%	do	do	Verify	Witness			
		Ensure that different accessories / loose supply material are stored separately , section and size wise labelled and tagged for easy identification	Visual	do	do	do	Verify				
		When stored in unpack condition care shall be taken to ensure match pole and mechanism are together.	Visual	do	do	do	Verify				
4	Pre installation	Check material is complete as per the BOQ / drawing	Visual	100%	Packing list/BOQ	Packing list/BOQ	Verify				
		Check size & type of hardware as per the drawing / BOQ.	Visual	100%	Packing list/BOQ	Packing list/BOQ	Verify				

		Check the overall dimensions/ Lay Out with foundations.	Visual	100%	GA Drawing	GA Drawing	Verify				
		Check Matching of foundation bolts / holes.	Visual	100%	Civil foundation drawings		Verify				
		Check all bearings are smooth & no contact jaw springs are loose.	Visual	100%	Instruction Manual		Verify				
		Ensured that lifting facility of suitable capacity is available.	Visual	100%	Instruction Manual	Instruction Manual	Verify				
		Ensured that proper tools and tackles are available.	Visual	100%	Instruction Manual	Instruction Manual	Verify				
		Check the verticality/Alignment of support structure.	Visual	100%	Instruction Manual	Instruction Manual	Verify	Witness			
5	Installation	Check mounting levels are correct.	Visual	do	As per instruction Manual	As per instruction Manual	Verify	Verify			
		Check the Vertical & Horizontal alignment of base frame before erection.	Visual	do	GA Drawing	GA Drawing	Verify	Witness			
		Check the proper installation & alignment	Visual	do	do	do	Verify				

		of MOM box.									
		Check the functioning of operating lever system and adjustment of drive coupling .	Visual	do	As per instruction Manual		Verify				
		Check the contact engagement and its synchronization.	Visual	do	do		Verify				
		Check Proper operation of Limit & auxiliary switch, mechanical interlock between Isolator & earth switch.	Measurement	do	do		Verify				
		Check glanding & tightness of the cables in the marshalling box.	Visual	do	do		Verify				
		Check Phase to phase and phase to earth clearance of poles.	Visual	do	GA Drawing		Verify				
		Check Earthing of Isolators as per Drawing .	Visual	do	do		Verify	Witness			
		Check direction of earth switch.	Visual	do	Erection Drawing.		Verify				
		Proper tightening of insulator fixing bolts and provision for washer at	Visual	do	As per instruction Manual		Verify				

		all places.									
		Cleanliness of insulator surface	Visual	do			Verify				
		Check Provision of cable /core Identification tags & ferrules.	Visual	do	Cable Schedule		Verify				
		Check Cable termination and tightness & sealing of unused holes.	Visual	do	As per instruction Manual		Verify	Verify			
6	Testing	General Checks as per STR.	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness			
		Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness	Witness		
		Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness			

S.No	Revision	Date	Legend	Contractor		Employer						
1												
2												

STANDARD FIELD QUALITY PLAN FOR HT/LT WORKS

STANDARD FIELD QUALITY PLAN FOR HT/LT WORKS											
						Issued on :					
Name of document :- FQP FOR HT/LT BUSDUCT WORKS						Rev :					
Name of Employer:-						FQP ref. No. FQP/ELECTRICAL/HT-LT-BUSDUCT/06					
Name of project:-						Doc No:					
Name of contractor:-											
Standard Field Quality Plan for HT/LT BUSDUCT											
S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES			FORMAT OF RECORDS	REMARKS
							Contractor	Consultant	Employer		
	RECEIPT										
1	Check the transportation documents	Gate pass, Excise duty, MDCC, LR.	Visual	100%	Delivery Challan & MDCC	Availability	Verify	Verify	Verify		
	Verify the technical Documents	Check the scheme drawing /GA drawing	Visual	100%	Packing list	Tender specification	Verify	Verify			
	Physical inspection of material	Visual examination for damage	Visual	Random	Manual	No Damage	Verify	Verify	Witness		

2	Qualification of Manpower	Hydra operator should have license	Visual	100%	Certificate	Availability	Verify	Verify			
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate	Availability	Verify	Verify			
3	Unloading and Storage	Ensure that the material is stored on raised wooden platform / Plank to avoid direct contact with ground / Moisture	Visual	100%	Instruction manual /Standard Engg. Practice	Availability	Verify	Verify	Verify		
		Ensure that the material is stored in systematic manner rating wise for easy removal	Visual	100%	Manual	Availability	Verify				
		Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification	Visual	100%	do		Verify	Verify			
		Keep the Bus Duct indoor and avoid any kind of wet condition in the premises.	Visual				Verify				
		Ensure that all hardware are tagged & kept separately in racks size-wise for easy identification	Visual	100%	do		Verify				
4	Pre Installation	Check for inspection agency stamp	Visual				Verify	Verify			
		Ensure the bus duct entry with civil drawing	Visual				Verify				

		Ensure that the contact surface of busbar, busbar bolts and nuts shall be thoroughly cleaned with petrol and wiped petroleum jelly.	Visual				Verify			
		check the levelling and verticality of the bus duct	Visual				Verify	Verify		
		Check the busbar, flexible Connector, hardware as per drawing etc.	Visual	100%	Drawing/Boq		Verify	Verify		
		Check size & type of hardware / accessories required as per the drawing / BOQ	Visual	100%	do		Verify			
		Ensure that no physical damage to HT/LT BUSDUCT body /insulator etc. is observed.	Visual	100%	No Damages.		Verify	Verify	Witness	
		Check the allocated bus duct position and dimension are correct and the access toward the HT/LT busduct free from blockage	Visual	100%	GA drawing		Verify			
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of HT/LT busduct etc.	Visual	100%			Verify			

		Check work area clean and safe	Visual				Verify				
5	Installation	Ensure that opening in the wall where the busducts enter the switch gear room shall be completely sealed to avoid rain water entry.	Visual				Verify				
		check the colour coding of the busbar	Visual				Verify				
		Ensure the tightness of the bolts and nuts.	Visual				Verify				
		Carry out the final check on the correct position of the HT/LT bus duct support frame and anchor it to the ceiling / wall with the aid of the anchoring fastener	Visual	do	GA DRAWING	GA DRAWING	Verify				
		Erect the different section of the HT/LT busduct with the rope / chain pulley system	Visual	do	GA DRAWING	GA DRAWING	Verify				
		Ensure the jointing of different section of HT/LT bus duct in the specified sequence as per drawing. .	Visual	do	GA DRAWING	GA DRAWING	Verify				

			Check the alignment and couple the section of bus duct as per drawing.	Visual	do	GA DRAWING	GA DRAWING	Verify				
			Ensure the cleanliness of bus bar and insulator after erection	Visual	do	As per Instruction Manual		Verify	Witness	Witness		
6	Testing		Routine Tests are as per Technical specification.	Visual	100%	specification		Verify	Witness	Witness		
			General Checks as mention in check list	Visual	100%	As per Instruction Manual	As per Instruction Manual	Verify	Witness	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness	Witness		
S.No.	Revision	Date	Legend	Contract	Consultant	Employer						
1												
2												

STANDARD FIELD QUALITY PLAN FOR EARTHING WORKS

Standard Field Quality Plan for Earthing Works

S.NO.	CHARACTERISTICS/ITEM	INSTRUMENT	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	Responsible Agencies		FORMAT OF RECORDS	REMARKS
						Contractor	Employer		
1	RECEIPT AND STORAGE								
1.1	RECEIPT OF MATERIALS								
1.11	Check for manufacturer's name as per Purchase Order identification punch mark/Detail as per the test certificates/Delivery Challan.		Visual	100%	Delivery Challan & Packing List	Verify	Verify		
1.12	Check for MDCC issued by Customer/Consultant/AREVA.		Visual	do	MDCC	Verify	Verify		
1.13	Check for visual damage/Cracks in earth electrodes/pipe/flats/shielded wire etc.		Visual	do	No Damages	Verify	Verify		
1.14	Check for dimensions and class/duty of earth electrodes/pipe/flat/hardware/shielded wire etc.		Measurement	do	Spec/BOQ	Verify	Verify		
1.15	Check for proper galvanisation and finishing of all parts of earthing system including hardware.		Visual	do	do	Verify	Verify		

1.2	STORAGE OF MATERIALS								
1.21	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground/moisture		Visual	Once in 3 months	Instruction Manual/standard engg. Practice	Verify	Verify		
1.22	Ensure that the material is stored in systematic manner for easy removal		Visual	Once in 3 months	do	Verify			
1.23	Ensure that different members of material are stored separately section and size wise labelled and tagged for easy identification		Visual	Once in 3 months	do	Verify			
1.24	Ensure that all hard ware kept separately in racks size-wise for easy identification		Visual	Once in 3 months	do	Verify			
2	INSTALLATION								
2.01	Excavation of earth pits upto required depth and the number of pits		Visual	100%	Drgs./Spec/IS	Verify			
2.02	Check for proper salt and charcoal layering in case of treated earth pit.		Visual	100%	do	Verify			
2.03	Check for quality of masonry, brickworks and cover plate for the earth chamber.		Visual	100%	do	Verify			
2.04	Check for burial depth of Electrodes.		Visual	do	do	Verify			

2.05	Check for burial depth of earthman.		Visual	do	do	Verify			
2.06	Check for size, overlap, welding quality of the earth riser.		Visual	do	do	Verify			
2.07	Check for overlap of joints		Visual	do	do	Verify			
2.08	Check for Usage of proper electrodes for welding		Visual	do	do	Verify			
2.09	Ensure that all earth strips are cut & drilled using proper tools like Hexsaw/drill machine etc and not by welding machine.		Visual	do	do	Verify			
2.10	Check for Proper application of protective bituminous tape /paint		Visual	do	do	Verify			
2.11	Check for Earth pits are properly prepared for electrodes		Visual	do	do	Verify			
2.12	Check for Earthing of structure/Poles		Visual	do	do	Verify			
2.13	Check for Clamping/support of earth flats		Visual	do	do	Verify			
2.14	Check for Earthing of cable supports		Visual	do	do	Verify			
2.16	Check for Earthing of fence and gates (at every 10 mtrs.		Visual	do	do	Verify			

2.17	Check for Earthing of all equipment structure		Visual	do	do	Verify			
2.18	Ensure that all outdoor HT & LT equipment like transformer, circuit breaker, CTs, PTs, isolator (with or w/o earth switch), LAs, cable trays etc. have been provided with double earthing.		Visual	do	do	Verify	Verify		
2.19	Ensure that all indoor HT & LT equipment like Switchgear panels, ACDBs, DCDBs, battery racks, if Applicable charger panels, capacitor panel, cable trays etc. have been provided with double earthing.		Visual	do	do	Verify			
2.20	Ensure that shield wire of the grid has been properly earthed at every tower.		Visual	do	do	Verify			
3	TESTING								
3.01	General inspection		Visual	do	SPEC/Drg/IS	Verify	Witness		
3.02	Individual Earth electrode Resistance Measurement	Earth Megger	Measurement	do	do	Verify	Witness		

3.03	Total Earth Grid resistance measurement	Earth Megger	Measurement	do	do	Verify	Witness		
3.04	All tests will be done as per technical specification			do	specification	Verify	Witness		
3.05	Final document review		Visual	do		Verify	Witness		

STANDARD FIELD QUALITY PLAN FOR HT PANELS

Standard Field Quality Plan for HT Panel.

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	Acceptance Norms	Responsible Agencies			FORMAT OF RECORDS	REMARKS
							Contractor	Consultant	Employer		
1	RECEIPT										
	Check the transportation documents	Gate pass, Excise duty doc, MDCC, LR etc.	Visual	100%	Packing List / BOQ	Availability	Verify	Verify	Verify		
	Verify the technical Documents	Check the Availability catalogues and operation manual	Visual	100%	Packing List / BOQ	Tender specification	Verify	Verify			
		Check the Factory test report, scheme Drawings / GA drawing	Visual	100%	Schematic drawing.		Verify				
	Physical inspection of material	Verify the no. of unit, name plate	Visual	100%	Delivery Challan & MDCC		Verify				
		Verify any kind of damage, scratch and	Visual	100%	Packing List / BOQ	No damage	Verify	Verify	Verify		

	unavailability of gasket.										
	verify the physical condition of selector switch ,toggel switch ,heater ,indication lamp etc.	Visual	100%	Invoice/Packing list/BOQ	Availability	Verify					
Verify the technical specification Name plate	Verify the rating of BREAKER, CT ,BUSBAR,PT etc.	Visual	100%	Technical specification	conformanc e	Verify					
	Verify the size and length of BUSBAR	Visual	100%	Approved drg	conformanc e	Verify					
	Make sure that the Relay mounted on the panels are according to the designed protection scheme.	Visual	100%	Technical specification	conformanc e	Verify					
	Verify the range of meters.	Visual	100%	Technical specification	conformanc e	Verify					
	verify the range of auxiliary AC and DC supply	Visual	100%	Scheme Drawing Technical specification	conformanc e	Verify					
Check the Availability of accessories	verify the availability of inter panel control wiring cable.	Visual	100%	Technical specification	conformanc e	Verify					
	verify the availability of CB rack in rack out and spring charge Handle	Visual	100%	Approved drg	Availability	Verify					

		verify the availability of grouting nut and bolt.	Visual	100%	Approved drg	Availability	Verify				
2	Qualification of Man power	Hydra operator should have license	Visual	100%	Certificate	Availability	Verify				
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate	Availability	Verify				
3	Unloading and storage	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture	Visual	Once in a month	Instruction Manual/ Standard engg. Practice		Verify				
		Ensure that the material is stored in systematic manner for easy removal.	Visual	do	do	Proper Safety	Verify				
		Ensure that different accessories / loose supply material are stored separate section and size wise labelled and tagged for easy identification	Visual	do	do	Proper Safety	Verify				
		Ensure all the safty procaution at the time unloading of panels and Cubical and man.	Visual	do	do	Proper Safety	Verify				

4	Pre installation	Visual inspection shall be done after unpacking	Visual				Verify				
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of HT Panel etc.	Visual	100%	Drawing	Availability	Verify				
		Check Matching of hole on HT Panel, and mounting foundation with layout plan.	Visual	100%	GA Drawing / BOQ	Availability	Verify				
		Ensure that availability of proper foundation / floor cut outs.	Visual	do	do	Availability	Verify				
		Ensure that no physical damage in Panel body /insulator etc. is observed.	Visual	do		Availability	Verify				
5	Installation	Check for inspection agency stamp	Visual			Availability	Verify				
		Lay out marking	Visual	100%	Floor level should be matched	As per drawing	Verify				

	Fixing of Base Channel	Visual	do	Specification	As per drawing	Verify				
	Shifting the panel to location by the using Hydra Or manually.	Visual	do	Drawing / BOQ	Availability	Verify				
	Grouting of panel to the base frame .	Visual	do	Specification	As per drawing	Verify				
	Fixing of Bus bar.	Visual	do	Alignment.	As per drawing	Verify				
	Assembling the panel components	Visual	do	Schematic drawing.	As per drawing	Verify				
	Cleanliness of the joint surface	Visual	do	Ensure	Cleanliness	Verify				
	Ensure that panel free from any kind of foreign particle	Visual	do	Standard engg. Practice	No foreign material	Verify	Verify			
	Tightness of Bus Bar Nut Bolt	Visual	do	IS Specification	Availability	Verify				
	NO live parts inside panel	Visual	do	Instruction Manual / Standard engg. Practice	Availability	Verify				

			Earth connection to the panel Earth Bus	Visual	do	Standard engg. Practice	As per drawing	Verify				
			Sealing of any kind of unnecessary Hole and opening	Visual	do	Standard engg. Practice	No extra hole	Verify				
6	Testing		General Checks as STR.	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness	Witness		
			Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness	Witness		
S.No	Revision	Date	Legend	Contractor		Employer						
1												
2												
3												

STANDARD FIELD QUALITY PLAN FOR CIRCUIT BREAKER

S.NO.	TITLE	CHARACTERISTICS / ITEMS	TYPE OF CHECK	QUANTUM / FREQUENCY OF CHECK	REF. DOC & ACCEPTANCE STANDARD	Acceptance Norms	Responsible Agencies		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
	RECEIPT OF MATERIALS									
1	Check the transportation documents	Gate pass, Excise duty, MDCC,LR etc.	Visual	100%	Delivery Challan & Packing List	Availability	Verify	Verify		
	Check the technical documents	Check the availability of Factory test report ,catalogues and operation manual.	Visual	100%	Packing List / BOQ	Availability	Verify			
	Physical inspection of material	Check for any physical damage.	Visual	100%	No damages		Verify	Verify		
		Check name plate details as per P.O	Visual	100%	Purchase order		Verify			
		Verify the case no. as per L.R.	Visual	100%	do		Verify			
2	Qualification of Man power	Hydra operator should have valid license.	Visual	100%	Certificate		Verify			
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate		Verify			

3	Unloading & Storage	Each Crate/case has to be unloaded one by one only.	Visual	100%			Verify			
		Ensure hydra/Crane can be used for the unloading purpose and using marks provided on case.	Visual	100%			Verify			
		Ensure that the material is stored on raised wooden platform/ Planks to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction Manual / Standard engg. Practice		Verify	Verify		
		Ensure that the material is stored in a systematic manner rating wise for easy removal / usage.	Visual	do	do		Verify			
		Ensure that different accessories / loose supply material are stored separately ,section and size wise labelled and tagged for easy identification.	Visual	do	do		Verify			
		Ensure that all hardware are tagged & kept separately in racks / in bags,size-wise for easy identification.	Visual	do	do		Verify			
		Ensure the SF6 gas cylinders shall be stored in Cap intact condition(provided for valve	Visual	do	do		Verify			

		protection) with valve fully closed and free from explosive environment.								
		Ensure Tarpaulin covers have been provided if required .	Visual	do	do		Verify			
		Ensure while in storage , on no account water shall enter the equipment.	Visual	do	do		Verify			
		Ensure Cu tube and ferrule, nipple, and fitting etc. to be stored together inside the room.	Visual	do			Verify			
		Check when stored in unpack condition care shall be taken to Ensure match pole and mechanism are together.	Visual	do	do		Verify			
4	Pre Installation	Ensure that the foundation for mounting CB cleared from civil works .	Visual	100%	Civil Construction clearance		Verify			
		Check size & type of hardware / Busbar coupling accessories required as per the drawing / BOQ	Visual	do	do		Verify			
		Ensure that no physical damage to CB body	Visual	do	NO Damages		Verify	Witness		

		/insulator etc.							
		Visual inspection shall be done after unpacking .	Visual	do			Verify	Witness	
		Ensure availability of proper foundation and structure.	Visual	do	GA Drawing		Verify		
		Check Matching of structure / Holes on CB, and mounting foundation bolts	Visual	do	GA Drawing		Verify		
		Ensure availability of necessary tools &, tackles, crane/Hydra , sling for lifting of CB, Sealer Anabond, Circlip plier, Bolts&nuts, derrick pipes, support, wire brush, emer sheet etc.	Visual	do	As per instruction Manual		Verify		
		Ensure the placement position of the phases and orientation of breaker on foundation.	Visual	do	Erection Drawings		Verify		
		Check for inspection agency stamp/punch.	visual	do			Verify		
		Ensure the availability of drawings.	Visual	do	Erection key diagram, scchematic diagram.		Verify		

5	Installation	Ensure the CB shall be gas filled & checked by manufacturer.	Visual	100%	As per instruction Manual/ Test report	As per instruction Manual/ Test report	Verify			
		Ensure that CB is always lifted using lifting hooks only and not from bushings etc.	Visual	100%	As per instruction Manual/ Test report	As per instruction Manual/ Test report	Verify			
		Ensure that the CB is not tilted during lifting.	Visual	do	do		Verify			
		Ensure to avoid giving jerk and the side seal does not hit anywhere	Visual	do	do		Verify			
		Check proper tightness of foundation nuts & bolts immediately after placement on the structure .	Visual	do	do		Verify			
		Check that center line and verticality of CB is correct and horizontal leveling.	Visual	do	do		Verify			
		Ensure once the links are attached, shall be tighten firmly with nuts and lock clips.	Visual	do	do		Verify			
		Ensure not to temper with the valve at any stage.	Visual	do	do		Verify			

		Check for mechanical indication to show open & close position.	Visual	do	do		Verify			
		Ensure fixing of accessories / loose supplied items if any.	Visual	do	do		Verify			
		Ensure top & bottom terminations and earthing connection to earth are done using correct size of lugs /strips / Connectors.	Visual	do	do		Verify			
		Ensure that touch up paint has been applied where ever peeled off.	Visual	do	do		Verify			
		Check the wiring diagram make the required connections	Visual	do	do		Verify			
		Check for any loose connections	Visual	do	do		Verify			
		Ensure to clean the joint surfaces of the the terminal adaptor with wire brush or emery sheet.	Visual	do	do		Verify			
6	Testing	General checks as per STR.	Visual	100%	As per instruction Manual	Availability	Verify	Witness		
		Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness		

			Ensure that complete site as built drawings/ documents alongwith test reports, reconciliation report, MTC, MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness		
S.No.	Revision	Date	Legend	Contractor		Employer					
1											
2											
3											

STANDARD FIELD QUALITY PLAN FOR CR PANEL

STANDARD FIELD QUALITY PLAN FOR CR PANEL										
S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Check the transportation documents	Gate pass, Excise duty,MDCC,LR.	Visual	100%	Packing List / BOQ	Availability	Verify	Verify		
	Check the technical Documents	Check the availability of Factory report,catalogues test and operation manual.	Visual	100%	Packing List / BOQ	Availability	Verify			
		Check the scheme Drawings /GA Drawing	Visual	100%	Schematic drawing.	Availability	Verify			
		Keep the panels indoor and avoid any kind of wet condition in the premises.	Visual	100%			Verify			
	Physical inspection of material	Verify the no of unit	Visual	100%	Delivery Challan & MDCC		Verify			
		Verify the any kind of damage, scratch and availability of gasket	Visual	100%	Packing List / BOQ	No damage	Verify	Verify		
		verify the physical condition of selector switch, toggel switch, heater, indication lamp etc.	Visual	100%	Invoice/ Packing List/ BOQ	Availability	Verify			

	Verify technical specification Name plate	the	Verify the rating of BREAKER, CT, BUSBAR, PT etc.	Visual	100%	Technical specification	conformance	Verify				
			Verify the size and length of BUSBAR	Visual	100%	Technical specification	conformance	Verify				
			Verify the proper insulation of BUS BAR	Visual	100%	Technical specification	conformance	Verify				
			Make sure the that Relay mount on the panels are according the designed protection scheme .	Visual	100%	Technical specification	conformance	Verify				
			Verify the Range of Auxiliary AC and DC supply.	Visual	100%	Technical specification	conformance	Verify				
			Verify the range of meters.	Visual	100%	Technical specification	conformance	Verify				
	Check Availability accessories	the	of	Verify the availability of inter panel control wiring cable.	Visual	100%	Technical specification	conformance	Verify			
				Verify the availability of CB rack in rack out and spring charge Handle	Visual	100%	Approved drg	Availability	Verify			
				Verify the availability of grouting nut and bolt.	Visual	100%	Approved drg	Availability	Verify			
2	Qualification of Man power		Hydra operator should have license	Visual	100%	Certificate	Availability	Verify				
			Fitter and Technician should be have relevant experience	Visual	100%	Certificate	Availability	Verify				
3	Quality of tools		Crane/Hydra	Visual	100%		Availability	Verify				
			Chain Pulley	Visual	100%		Availability	Verify				

		Breaker Trolley	Visual	100%		Availability	Verify			
		Mobile Scaffold	Visual	100%		Availability	Verify			
		Welding machine.	Visual	100%			Verify			
4	Unloading & Storage	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture	Visual	Once in a month	Instruction Manual / Standard engg. Practice	Instruction Manual / Standard engg. Practice	Verify	Verify		
		Ensure that the material is stored in systematic manner rating wise for easy removal	Visual	100%	do	Instruction Manual / Standard engg. Practice	Verify			
		Panels to be stored inside	Visual	100%			Verify			
		Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification	Visual	do	do	Instruction Manual / Standard engg. Practice	Verify			
		Ensure that all hardware are tagged & kept separately in racks size-wise for easy identification	Visual	do	do		Verify			
5	Pre Installation	Check for inspection agency stamp/punch.	Visual	100%			Verify			
		Check size & type of hardware / accessories required as per the drawing / BOQ	Visual	100%	do		Verify			

		Ensure that availability of proper foundation and floor.	Visual	do	Civil Drawing		Verify			
		Check Matching of Hole on C&R Panel, and mounting foundation.	Visual	do	GA Drawings		Verify			
		Visual inspection shall be done after unpacking.	Visual	do			Verify			
		Check for indicating instruments mounted on panel.	visual	do			Verify			
		Check for inspection agency stamp/punch.	Visual	do			Verify			
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of C&R Panel etc.	Visual	do	Instruction Manual / Standard engg. Practice		Verify			
		Ensure the availability of schematic drawing of C & R panel.	Visual	do	Schematic Drawings		Verify			
6	Installation	check that panels are erected as per layout drawing.	Visual	100%	Layout drawing.					
		Check verticality of equipment on support structure & Leveling.	Visual	100%	Instruction Manual / Standard engg. Practice		Verify			
		Check the earth bus connection.	Visual	do	GA Drawings		Verify			
		Check for painting of base frame.	Visual	do			Verify			
		Check the completeness of supply.	Visual	do	Schematic Drawings	Schematic Drawings	Verify			

			Check the inter panel wiring.	Visual	do	Schematic Drawings		Verify			
			Ensure the proper dressing of panel wiring.	Visual	do	Properly Dressed		Verify			
			Ensure the glanding of external cables	Visual	do	Properly Glanding		Verify			
			Ensure the blanking of unused cable entry holes	Visual	do	GA Drawings		Verify			
			Ensure the proper sealing and locking arrangement of panel door.	Visual	do	GA Drawings		Verify			
7	Testing		General Checks as per STR.	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness		
			Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness		
S.No	Revision	Date	Legend	Contractor		Employer	Employer				

STANDARD FIELD QUALITY PLAN FOR ACDB Panels

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANC E NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Check the transportation documents	Gate pass, Excise, MDCC, LR.	Visual	100%	Delivery Challan & MDCC	Availability	Verify	Verify		
	Check the technical documents	Check the availability catalogues, operation manual, Factory test report .	Visual	100%	Packing List / BOQ	Availability	Verify			
		Check the scheme Drawings/ GA Drawing	Visual	100%	Schematic drawing.	Availability	Verify			
	Physical inspection of material	Verify the No of unit			Packing List / BOQ		Verify			
		Check the quality of Paint and Sheet material of panel body	Visual	100%	Packing List / BOQ	Availability	Verify			
		Verify any kind of physical damage, scratch and availability of Gasket	Visual	100%	No damage	No damage	Verify	Verify		
		Verify the physical condition of the Selector Switch, Toggle Switch,	Visual	100%			Verify			

		Indication Lamp, Inspection Lamp etc.							
		Check the availability of Space heater, bakelite sheet and Inspection light	Visual	100%	GA drawing	GA drawing	Verify		
		Verify the size of the panel (Length and Breath)	Visual	100%	Packing List / BOQ		Verify		
	Verify the technical specification Name plate	Verify the ratings of Breaker ,Bus Bar, CTs, PTs Etc with the specification	Visual	100%	Technical specification	Availability	Verify		
		Verify the size of the Bus Bar with its current Ratings and short circuit Ratings and availability of Sleeve/ Epoxy paint	Visual	100%	Technical specification	As per drawing	Verify		
		Verify the proper insulation of Bus Bar	Visual	100%	Technical specification	As per drawing	Verify		
		Ensure that Relays mounted on the panels are according to designed protection Scheme	Visual	100%	GA drawing	GA drawing	Verify		
		Verify the Range of Meters	Visual	100%	Technical specification		Verify		

		Verify the Range of Auxiliary AC and DC supply	Visual	100%			Verify			
		Verify the availability of inter Panel control wiring Cable	Visual	100%	Schematic drawing.		Verify			
		Verify the availability of breaker Rack in Rack out and spring Charge Handle	Visual	100%			Verify			
2	Qualification of Manpower	Hydra operator should have license	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician should have relevant experience	Visual	100%	Certificate	Availability	Verify			
3	Quality of Tools	Crane/Hydra	Visual	100%		Availability	Verify			
		Chain Pulley	Visual	100%		Availability	Verify			-
		Breaker Trolley	Visual	100%		Availability	Verify			
		Mobile Scaffold	Visual	100%		Availability	Verify			
		Welding machine.	Visual	100%		Availability	Verify			

4	Unloding and Storage	Ensure all the safety precautions at the time unloading of panels and Cubicle(Both man and material).	Visual	Once in a month	Instruction manual/ Standard engg. Practice	conformance	Verify			
		Use sling of proper size and quality during process of unloading.	Visual	100%	do	conformance	Verify			
		Keep the panels indoor and avoid any kind of wet condition in the premises.	Visual	100%	do	conformance	Verify			
5	Pre installation	Check for inspection agency stamp.	Visual				Verify			
		Check the availability of site.	Visual	100%	Drawing / BOQ	Availability	Verify			
		Verify the foundation of panel.	Visual	do	do	Availability	Verify			
		Ensure Proper Tools and Procedure for shifting and installation of panel.	Visual	do		Availability	Verify			
		Ensure all precautionary measure for man and material.	Visual	do		Availability	Verify			
		Verify the availability of all the accessories like Grouting Nut Bolt, Bus	Visual	do	Packing List	Availability	Verify			

		Bar ,connecting Nut Bolt,Founadtion Gasket.								
6	Installation	Check the lay out marking.	Visual	do	GA drawing	conformance	Verify			
		Ensure the fixing of Base Channel.	Visual	do	do	conformance	Verify			
		Ensure the shifting of panel to the location by using Hydra or Trailer with safety and precaution.	Visual	do	Manufacturer instruction manual	conformance	Verify			
		Ensure the grouting of panel to the base frame.	Visual	do	Manufacturer instruction manual	conformance	Verify			
		Check the assembling of panel components.	Visual	do	do	conformance	Verify			
		Ensure the fixing of Bus Bar.	Visual	do	Schematic drawing.	conformance	Verify			
		Ensure cleanliness of the joint surfaces .	Visual	do	Manufacturer instruction manual	conformance	Verify			
		Ensure that panel is free from any kind of foreign particle.	Visual		do	conformance	Verify			
		Check the tightness of Bus Bar nut bolt.	Visual		do	conformance	Verify			

		Ensure the firm earth connection to the panel Earth Bus.	Visual	do	Earthing drg	conformance	Verify			
		check for any scratches and apply touch up paint.	Visual				Verify			
		Ensure the sealing of any kind of unnecessary Holes and openings.	Visual	do		conformance	Verify			
7	Testing	General checks as per STR.	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness		
		Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness		
		Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	As built drg/Schematic drawing.	Availability	Verify	Witness		

S.No.	Revision	Date	Legend	Contract	Consultant	Employer					
1											
2											
3											

STANDARD FIELD QUALITY PLAN FOR DCDB Panels

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Check the Transportation documents	Gate pass, Excise duty doc, MDCC,LR,etc.								
	Verify the technical Documents	Check the availability of Factory test report, catalogues and operation manual	Visual	100%	Delivery Challan & MDCC	Delivery Challan & MDCC	Verify	Verify		
		Check the scheme Drawings/ GA Drawing	Visual	100%	Packing List / BOQ	Delivery Challan & MDCC	Verify			
	Physical inspection of material	Verify the any kind of damage ,scratch and availability of gasket	Visual	100%	Delivery Challan & MDCC	Availability	Verify			
		verify the physical condition of selector switch ,toggel switch ,heater ,indication lamp etc.	Visual	100%	Packing List / BOQ	Availability	Verify	Verify		
2	Qualification of manpower	Hydra operator should have license	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician should have relevant experience	Visual	100%	Certificate	Availability	Verify			
3	Unloading and storage	Keep the panels indoor and avoid any kind of wet condition in the premises	Visual	100%			Verify			

		Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture	Visual	Once in a month	Instruction manual Standard engg. Practice	Availability	Verify	Verify		
		Ensure that the material is stored in systematic manner rating wise for easy removal	Visual	100%	do		Verify			
		Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification	Visual	do	do		Verify			
4	Pre installation	Check for inspection agency stamp/punch.	Visual	100%			Verify			
		Check name plate details of the DCDB Panel with drawing / BOQ	Visual	100%	GA Drawing / BOQ	GA Drawing / BOQ	Verify			
		Ensure that availability of proper foundation and floor.	Visual	do	Civil layout drawing		Verify			
		Check matching of floor / Hole on DCDB Panel, and mounting foundation.	Visual	do	GA Drawings	GA Drawings	Verify			
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of DCDB Panel etc.	Visual	do	Instruction manual/ Standard engg. Practice		Verify			

5	Installation	Ensure that base channels shall be grouted	Visual	do	layout drawing		Verify			
		Bolt tightness checking of panel with base frame in case of bottom entry of cables	Visual				Verify			
		Check the lubrication of moving part	Visual				Verify			
		Check the Earth bus connection at two different point	Visual	do	Schematic drawing.	Availability	Verify			
		Ensure that power and control cables are terminated with proper ferruling	Visual	Random	do	Availability	Verify			
		Ensure correct sizes of cable are used and properly tagged.	Visual	do	do	Availability	Verify			
		Check healthiness of fuses, links, MCBS, Switches, indication lamps, push buttons, space heater & illumination circuit.	Visual	do	Instruction manual/ Standard engg. Practice	Availability	Verify			
		Check the wires are dressed & routed properly.	Visual	Random	—	Availability	Verify			
		Check the metering circuit.	Measurement	do	do		Verify			
		Check the polarity of shunt, ammeter, voltmeter etc.	Measurement	do	do		Verify			
		Check space heater for continuity .	Measurement	do	do		Verify			
		Check indicating lamps' rating and their circuits and ensure their colours are in order.	Visual	do	do		Verify			
		Check door alignment.	Visual	do	do		Verify			

			Check door lock facility.	Visual	do	—		Verify			
			Check cleanliness of the board.	Visual	do	—		Verify			
			Check function of all switch fuse units.	Visual	do	—		Verify			
			Checked for broken glass, switch handle, lamp cover etc.	Visual	do	—		Verify			
			Ensure blanking of unused cable entry holes.	Visual	do	GA Drawing		Verify			
			Ensure proper sealing and locking arrangement of panel door.	Visual	do	GA Drawing		Verify			
			Check that the relays and meters are flush mounted on the front of the panels.	Visual	do	GA Drawing		Verify			
6	Testing		General Checks as per STR.	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness		
			Routine Tests are as per Technical specification.	Testing	100%	Technical Specification	Availability	Verify	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness		
S. No.	Revision	Date	Legend	Contractor		Employer	Client				
1											
2											
3											

STANDARD FIELD QUALITY PLAN FOR AL BATTERY CHARGER

Standard Field Quality Plan for Battery Charger Panel.

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
	RECEIPT									
1	Transportation Documents	Gate pass, Excise duty, MDCC,LR.	Visual	100%	Delivery Challan & MDCC	Availability	Verify			
		Check for Manufacturer's name as per Delivery Challan.	Visual	100%	Delivery Challan & MDCC	Tender specification	Verify			
	Technical documents	Check the Factory test report ,scheme drawing /GA drawing .	Visual	100%	Packing List / BOQ	Availability	Verify			
	Physical inspection of material	Check supply of accessories / Loose supply items (if any).	Visual	100%	Packing List / BOQ	Availability	Verify			
		Visual examination for damage.	Visual	100%	NO Damages	NO Damages	Verify			
2	Qualification of Man power	Hydra operator should have license.	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician should have relevant experience .	Visual	100%	Certificate	Availability	Verify			

3	Unloading and Storage	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction Manual/ Standard engg. Practice	Availability	Verify			
		Ensure that different accessories / loose supply material are stored separate section and size wise labelled and tagged for easy identification.	Visual	100%	do		Verify			
		Ensure that all hardware are tagged & kept separately in racks, size-wise for easy identification	Visual	100%	do		Verify			
4	Pre installation	Check for proper ventilation and illumination in working condition.	Visual	100%			Verify			
		Check name plate details of the Bat. Charger Panel with drawing / BOQ	Visual	100%	GA Drawing / BOQ	Availability	Verify			
		Check size & type of hardware/ accessories required as per the drawing / BOQ.	Visual	do	Packing List / BOQ	Availability	Verify			
		Ensure that no physical damage to Bat. Charger Panel body /insulator etc. is observed.	Visual	do	No damage		Verify	Verify		

		Ensure that availability of proper foundation and floor cut out.	Visual	do	Civil cut out drawing		Verify			
		Check Matching of floor cut out / Hole on Bat. Charger Panel, and mounting foundation.	Visual	do	GA Drawings	GA Drawings	Verify			
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of Bat. Charger Panel etc.	Visual	do	Instruction Manual/ Standard engg. Practice	Standard engg. Practice	Verify			
5	Installation	Check the Verticality of Charger on support structure & Leveling.	Visual	100%			Verify			
		Check for broken glass, switch handle, lamp cover etc.	Visual	do	No Damages	Availability	Verify			
		Check all nuts, bolts, clamps, connectors and terminals are tightened correctly.	Visual	do	Drawing / BOQ	Availability	Verify			
		Check the panel clearance from any equipment and wall.	Visual	do	Specification	Availability	Verify			
		Ensure that power and control cables are terminated with proper ferruling.	Visual	do	Schematic drawing.	Availability	Verify			
		Check for proper connection and tightness of all wires.	Visual	do	Standard engg. Practice		Verify			

		Check for completion of wiring as per schematic drawing.	Visual	do	Schematic drawing.		Verify			
		Check healthiness of fuses, links, MCBs, Switches, indication lamps and space heater & illumination circuit.	Visual	do	Instruction Manual / Standard engg. Practice		Verify			
		Check cables are supported properly.	Visual	do	Standard engg. Practice		Verify			
		Check mounting arrangement of relays, PCBs, chokes and transformer visually.	Visual	do	GA drawing.	GA drawing.	Verify			
		Check tightness against proper mounting of SCRs and Diodes on their heat sinks.	Visual	do	GA drawing.		Verify			
		Check Polarity of meters shunts and relays.	Visual	do	Schematic drawing.		Verify			
		Ensure proper glanding of external cables	Visual	do	GA Drawing		Verify			
		Ensure blanking of unused cable entry holes.	Visual	do	GA Drawing		Verify			
		Check for earthing of the panel at 2 places grounded individually to different grounding pads.	Visual	do	Earthing Drg		Verify			

6	Testing		General Checks as per STR.	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness		
			Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report, MTC, MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness		
S.No.	Revision	Date	Legend	Contract		Employer					
1											
2											
3											

STANDARD FIELD QUALITY PLAN FOR AL BATTERY BANKS WORKS

Standard Field Quality Plan for Battery Bank.

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Check the Transportation documents	Gate pass, Excise duty MDCC, LR.	Visual	100%	Invoice/ packing list	Availability	Verify	Verify		
	Check the technical documents	Check the Factory test report, scheme drawing /GA drawing.	Visual	100%	Invoice/ packing list	Availability	Verify			
		Check supply of accessories/ Loose supply items (if any).	Visual	100%	Packing List/ BOQ	Availability	Verify			
		Verify the AH Rating of Battery	Visual	100%	Packing List/ BOQ	Availability	Verify			
		Verify the Voltage and Frequency	Visual	100%	Packing List/ BOQ	Availability	Verify			
		Check the availability of Catalogues and operation manual	Visual	100%	Packing List / BOQ	Availability	Verify			
	Check the physical inspection	Check for any physical damage.	Visual	100%	Packing List / BOQ	Availability	Verify	Verify		
		Check name plate details as per P.O	Visual	100%	Invoice /packing list	Availability	Verify			
		Verify the case no. as per L.R.	Visual	100%		No Damages	Verify			

	Verify the Technical specification(Name Plate Details)	Verify the AH rating of Battery.	Visual	100%	Technical specification/BOQ	Conformance	Verify	Witness		
		Verify the Voltage Rating.	Visual	100%	Technical specification/BOQ	Conformance	Verify	Witness		
		Verify Input Voltage and Frequency.	Visual	100%	Technical specification/BOQ	Conformance	Verify	Witness		
2	Qualification of Man power	Hydra operator have license.	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician is having relevant experience .	Visual	100%	Certificate	Availability	Verify			
3	Quality of Tools	Trolley	Visual	100%		Availability	Verify			
4	Unloading and Storage	Ensure that the material is stored inside on raised wooden platform to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction manual/ Standard engg. Practice	Conformance	Verify	Verify		
		Ensure proper unloading & storage of battery.	Visual	100%	do	Availability	Verify			
		Battery shall be kept in Dust free indoor area.	Visual	do	do	Availability	Verify			
5	Pre installation	Verify the location for installation of battery	Visual	100%	Drawing		Verify			
		Ensure proper tools and planning for Shifting and Installation of battery bank	Visual	100%	GA Drawing / BOQ		Verify			
		Verify the availability of all accessories like connecting lead.	Visual	do	do		Verify			

6	Installation	Cleaning of terminals	Visual				Verify			
		cleaning of premises	Visual				Verify			
		tap cell connection shall be made at 80% of battery bank	Visual	100%		conformance	Verify			
		Anchored the stand for the battery .	Visual	100%	Floor level should be matched		Verify			
		Battery shall be handled carefully.	Visual	do	No Damages		Verify			
		Check all nuts, bolts, clamps, connectors and terminals are tightened correctly.	Visual	do	Drawing / BOQ		Verify			
		Batteries shall be arranged in such a way that positive and negative terminals of adjacent batteries are nearby.	Visual	do	Specification		Verify			
		Connect positive terminals of one battery to the negative terminal of other battery.	Visual	do	No Misalignment.		Verify			
		Ensure correct sizes of cable are used and properly tagged.	Visual	do	Schematic drawing.		Verify			
		Ensure sufficient torque for tightening of terminals.	Visual	do	Standard engg. Practice		Verify			
		Apply petroleum jelly at battery terminal.	Visual	do	Instruction manual / Standard engg. Practice		Verify			
		Numerical nomenclature of the battery bank.	Visual	do	Standard engg. Practice		Verify			

7	Testing		General checks as per STR.	Visual	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness			
			Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness			
			Ensure that complete site as built drawings / documents alongwith test reports & reconciliation report have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness			
S.No	Revision		Date	Legend		Sub Contractor			Client			
1												
2												
3												

STANDARD FIELD QUALITY PLAN FOR AL BUS BAR WORKS										
Standard Field Quality Plan for AI. BUS BAR										
S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Check the transportation documents	Gate pass, Excise duty, MDCC,LR	Visual	100%	Delivery Challan & MDCC	Availability	Verify	Verify		
		Check for Manufacturer's name as per Delivery Challan.	Visual	100%	Delivery Challan & MDCC	Availability	Verify			
	Check the technical document	Check the Factory test report,GA drawing.	Visual		Delivery Challan & MDCC	Availability	Verify			
	Physical inspection of material	Check for Quantity and size of AL tube.	Visual	100%	Packing List / BOQ	Availability	Verify			
		Verify the size and thickness of Bus BAR.	Visual	100%	Packing List / BOQ	Packing List / BOQ	Verify			
		Verify the any kind of damage .	Visual	100%	Packing List / BOQ	No damage	Verify			
2	Qualification of Man power	Hydra operator should have license.	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician should be have relevant experience.	Visual	100%	Certificate	Availability	Verify			

3	Unloading and storage of materials	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction manual /Standard engg. Practice	Availability	Verify	Verify		
		Ensure that the material is stored inside in systematic manner rating wise for easy removal.	Visual	100%	do	Availability	Verify			
		Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification.	Visual	100%	do	Availability	Verify			
4	Pre installation	Check the busbar hardware as per drawing.	Visual	100%	GA Hardware drawing	GA Hardware drawing	Verify			
		Ensure that the bus bar free from cut and othe damage.	Visual	100%	No Damages.		Verify			
		Check the length and bends of Bus Bar as per drawing.	Visual	100%	GA Hardware drawing		Verify			

		Ensure availability of necessary tools &, tackles and insulator for lifting of Bus Bar.	Visual	100%	Instruction manual/ Standard engg. Practice	Instruction manual	Verify			
5	Installation	Ensure the Shifting of Bus Bar from lorry/ manually .	Visual	do	GA DRAWING		Verify			
		Ensure the Installation the Bus Bar with the help of hydra Or manually	Visual	do	GA DRAWING		Verify			
		Ensure the colour sleeve (R,Y,B) shall be used in Bus Bar.	Visual	do	GA DRAWING		Verify			
		Ensure the proper size of Bus Bar on the insulator or other equipment as per approved drawing .	Visual	do	GA DRAWING		Verify			
		Ensure the Bus Bar shall be properly tightened with the clamp and connector.	Visual	do	As per Instruction Manual		Verify			
6	Testing	General Checks as per SIR	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness		
		Routine Tests are as per	Testing	100%	specification		Verify	Witness		

			Technical specification.								
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness		
S. NO.	Revision	Date	Legend	Contractor		Employer					
1											
2											
3											

STANDARD FIELD QUALITY PLAN FOR APFC PANEL

Standard Field Quality Plan for APFC PANELS

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Transportation Documents	Gate pass, Excise duty, MDCC, LR	Visual	100%	Packing list	Packing list	Verify			
		Check for Manufacturer's name as per Delivery Challan	Visual	100%	Packing list	Packing list	Verify			
	Technical documents	Check the Factory test report, scheme drawing and GA drawing	Visual	100%	MDCC/Delivery Challan	MDCC/Delivery Challan	Verify			
	Physical inspection of material	Check supply of accessories / Loose supply items (if any)	Visual	do	Packing List	Availability	Verify			
		Visual examination for damage and Availability of gasket.	Visual	do	No Damage	Availability	Verify			
2	Qualification of Man power	Hydra operator should have license.	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician should be have relevant experience.	Visual	100%	Certificate	Availability	Verify			

3	Unloading and Storage	Ensure that the material is stored inside on raised wooden platform to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction Manual/ Standard engg. Practice	Availability	Verify			
		Ensure that the material is stored in systematic manner for easy removal.	Visual	do	do	Availability	Verify			
		Ensure that different accessories / loose supply material are stored separate section and size wise labelled and tagged for easy identification.	Visual	do	do	Availability	Verify			
		Ensure that all hardware are tagged & kept separately in racks,size-wise for easy identification	Visual	do	do		Verify			
4	Pre Installation	Ensure that the foundation for mounting for APFC panels have been rigidly constructed & cleared from civil end.	Visual	100%	GA Drawing/Civil drawing		Verify			
		Check the proper foundation/floor cut outs as per GA drawing.	Visual	100%	GA Drawing/Civil drawing for floor cut outs.		Verify			

		Ensure the availability of necessary tools & tackles, crane/Hydra & sling for lifting of APFC panels.	Visual	100%			Verify			
		Ensure that there is no physical damage to the APFC panels while shifting for erection.	Visual	100%			Verify			
5	Installation	Ensure that the capacitor units are correctly positioned in the rack.	Visual	100%	GA drawing		Verify			
		Ensure that there is no damage to the capacitor body during erection.	Visual	100%	GA drawing		Verify			
		Ensure that no capacitor shall be interchanged between bank to bank.	Visual	100%	Manufacturer Erection manual/ Drawing.		Verify			
		After complete installation of the racks, Ensure that the post insulators, bus bars/jumpers & clamps are properly connected.	Visual	100%	Manufacturer Erection manual/ Drawing.		Verify			

		Ensure that the bushings are not over-tighted while connecting jumpers.	Visual				Verify			
		Ensure proper connections of the CT and PT with respect to polarity .	Visual	100%	Connection Diagram		Verify			
		Check the operations of all electrical inter-locks if any.	Visual	100%	Circuit Diagram		Verify			
		Check the earthing connections.	Visual	100%	GA drawing		Verify			
		Check the settings of the protection circuits & protective relay's operation.	Visual	100%	Manufacturer Instruction manual/ Relay setting data		Verify			
6	Testing	General Checks as per STR	Testing	100%	Instruction manual	As per drawing	Verify	Witness		
		Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness		
		Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report, MTC,MIR have been handed over to	Visual	100%	Schematic drawing.	Availability	Verify	Witness		

			projects/ engineering & receipt obtained.								
S.No.	Revision	Date	Legend	Contract		Employer					
1											
2											
3											

STANDARD FIELD QUALITY PLAN FOR CABLE TRAYS

Standard Field Quality Plan for HT Panel.

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Check the transportation documents	Gate pass, Excise duty, MDCC, LR.	Visual	100%	Delivery Challan & MDCC	Tender specification	Verify	Verify		
	Physical inspection of material	Make sure that material junk free.	Visual	100%	Delivery Challan & MDCC	Delivery Challan & MDCC	Verify			
		Verify the size and thickness of trays and tag them.	Visual	100%	Packing List / BOQ	No damage	Verify			
		Verify any kind of damage	Visual	100%	Packing List / BOQ	No damage	Verify	Verify		
	Check the Availability of accessories	Verify the availability of Coupling plate and bolts	Visual	100%	Technical specification	conformance	Verify			
2	Qualification of Man power	Hydra operator should have license	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate	Availability	Verify			

3	Unloading and Storage	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture	Visual	Random	Instruction Manual/ Standard engg. Practice		Verify	Verify		
		Ensure that the material is stored in systematic manner for easy removal.	Visual	Random	do	Proper Safety	Verify			
4	Pre installation	Ensure availability of approved Drawing /Documents for cable trays /routing	Visual	100%	Drawing	Availability	Verify			
		Completeness of all accessories like Coupler clamp and hardware	Visual	100%	GA Drawing / BOQ	Availability	Verify			
		Ensure that there is no physical damage during storage	Visual	do	do	Availability	Verify	Witness		
5	Installation	Availability of site front and finialize the size of cable tray according the approved drawing of trench and check that no piping /ducting in the route.	Visual	100%	Approved drg	As per drawing	Verify			

		Route marking	Visual			As per drawing	Verify				
		Verify the support arrangment	Visual	do	Approved drg	As per drawing	Verify				
		Ensure that cable trays are not cut by using elctric arc welding	Visual				Verify				
		Verification of readymade cable trays and cleaning of cable tray length.	Visual	do	Drawing / BOQ	Availability	Verify				
		Verification of jointing of cable trays	Visual	do	Specification	As per drawing	Verify				
		Ensure the alignment of cable trays both vertical and horizontal	Visual	do	Approved drg	As per drawing	Verify				
		Earthing of the cable tray	Visual	do	Approved drg	As per drawing	Verify				
		Collection and disposal of garbage	Visual	do	Approved drg	As per drawing	Verify				
6	Testing		NA								
S.No	Revision	Date	Legend	Contra ctor		Employer	Client				

STANDARD FIELD QUALITY PLAN FOR CONTROL CABLE LAYING									
Standard Field Quality Plan for HT/LT/CONTROL Cable Laying									
S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS		RESPONSIBLE AGENCIES	FORMAT OF RECORDS
						Contractor	Employer		
1	MATERIAL RECEIPT								
1.01	Check the Type, Make, Quantity, Name plate detail of cables received from Vendor.		Visual	100%	Packing List, Challan, MTC, MIR	Verify			In case any of these is not OK, Project Manager must be informed.
1.02	Check damages to cable drums/ outer/ turns of the cables.		Witness	do	NO Damages	Verify	Verify		
1.03	Check cable ends are sealed properly		Witness	do	Packing List,Challan	Verify			
1.04	Check cable details are clearly visible on make, PO details the drums sequential marking.		Witness	do	do	Verify			
1.05	Check the megger value of Cable on receipt.	Megger 500V/5KV	Measurement	do	Material inspection record	Verify			
1.06	Check unloading facility is suitable and adequate.		Visual	do		Verify			

2	STORAGE								
2.01	Ensure that while moving the drums by rolling them on ground, it should always be rolled in the direction of arrow marked on the drum.		Visual	Once in a Month	Work Instruction / Manual	Verify			
2.01	Check if the storage area is level and dry.		Visual	do	do	Verify	Witness		
2.01	Check if all drums are properly placed with stoppers so that any accidental rolling is avoided.		Visual	do	do	Verify			
2.01	Ensure the storage in manner that Identification of drums should be easy to avoid frequent movements unnecessarily		Visual	do	do	Verify			
2.01	Ensure tightness of cable drum bolts of flanges before transportation to work site		Visual	do		Verify			
3	PRE ERECTION								
3.01	Ensure that route is clearly defined as per drg. & necessary approvals are taken from for roads crossing, traffic movement etc. as applicable			100%	Cable route drawing	Verify			

3.02	Preplan cut length schedule to minimize wastage, as per the approval drawings/cables route.	Measuring tape	Measurement	do	Cable Schedule	Verify			
3.03	Check if the drums are placed properly at site.		Visual	do		Verify			
3.04	Check adequate no. of rollers are all placed on the cable route.		Visual	do		Verify			
3.05	Check if all rollers movements are free and do not have sharp edges,		Visual	do		Verify			
3.06	Check proper size of the cable is being laid as per the cable schedule.		Visual	do		Verify			
3.07	Check the IR and continuity of cable before laying.	Megger	Measurement	do	As per IS	Verify			Cable ends for HT cables to be kept sealed.
3.08	Pre plan availability of adequate qty. of sand /bricks/pre cast slabs /route markers for protection & cushioning of cables.			do	As per typical arrangement drgs.	Verify			
3.09	Check the availability of Jointing kit/Termination kit/tools and tackles.			do	Standard engg practice.	Verify			
3.10	Ensure the qualification of Cable joiner.		Witness	do	Approved Joiner	Verify			

3.11	Ensure that cable support structures are fabricated / painted strictly as per the approved drawing .		Visual	do	Typical arrangement drgs.	Verify			
4	ERECTION								
4.01	Ensure that proper cable jacks & shafts are used.		Visual	100%	Work Instruction / Manual	Verify			
4.02	Ensure that all conduits and ducts are free from sharp edges or foreign material.		Visual	do	do	Verify			
4.03	Ensure that proper method is adopted for cables being pulled through conduits and ducts.		Visual	do	do	Verify			
4.04	Check Depth / Width of trench and clearances..	Measuring tape	Measurement	Random	Approved Drawing	Verify			
4.05	Ensure that no. of bricks, stone slabs and sand etc. are filled as per the specifications.	do	do	do	Specification	Verify			
4.06	Ensure that proper horizontal / vertical spacings are maintained as per the approved drawings.	do	do	do	Approved Drawing	Verify			
4.07	Ensure the adequate loop is left while jointing as per specification.		Visual	100%	Specification	Verify			

4.08	Cable Glanding, dressing of cores of Cable & Tightness of Cable terminations		Visual	Random		Verify			
4.09	Sealing of Gland plates & cable entries to Building		Visual	do		Verify			
4.10	Clamping/ Supporting of Conduits & sealing of ends after Cable laying		Visual	do	Approved Drawing	Verify			
4.11	Cleaning of cable trench after cabling & providing the Cable trench covers		Visual	do		Verify			
4.12	Ensure that before backfilling of trenches, a joint inspection is done & protocol is signed by both contractor & project engineer.		Visual	do	Approved Drawing	Verify	Verify		
4.13	Ensure that cable identification tags are provided at proper places.		Visual	100%	Approved Drawing/ specification	Verify			
4.14	Ensure that cable joints markers are provided at all joints and route markers at regular intervals / warning tapes along the route as per specification.		Visual	do	Drgs & Specification	Verify			
4.15	Ensure that cable end of left out cable are. properly sealed to prevent ingress of moisture.		Visual	do		Verify			

4.16	Check dimension of tray and its galvanizing quality before laying the cable		Visual			Verify			
4.17	Ensure that the spare pipe ducts are sealed with end cap and provided with GI wire for future pulling purpose.		Visual	do	Drgs & Specification	Verify			
5	PRE-COMMISSIONING								
5.01	Ensure that cable identification tags are provided at proper places.		Visual	100%	Approved Drawing/ specification	Verify			
5.03	Ensure that cables are properly clamped at regular intervals on trays		Visual	do	do	Verify			
5.04	Ensure that suitable sleeves are provided for wall crossing etc., for cables		Visual	do	do	Verify			
5.05	Ensure that cable of higher voltage grade are laid on top tier and lower voltage grade on bottom tier while laying cables.		Visual	do	Instruction manual/ specification	Verify			
5.06	Ensure that proper spacing and layers are maintained for laying of cables		Visual	do	do	Verify			

5.07	Ensure that cable markers and bricks slabs are provided for directly buried cables.		Visual	do	do	Verify			
6	Testing								
6.01	Check the insulation resistance of the CC/ LT/ HT cables.	500/1000 V Megger	Witness	do	Specification	Verify	Witness		
6.02	Ensure that continuity test is conducted on conductor, Shield, Armour of H.T./LT Cables and cable tray earthing.	Megger/ Multimeter	Witness	do		Verify	Witness		
6.03	Ensure that high pot (HV) test is conducted on H.T. Cables.	HI Pot Test KIT	Witness	do	Specification	Verify	Witness		
6.04	Ensure that As built drawings, Cable schedule & test reports have been submitted to Client, projects team.				Cable Schedule, Test report as built drawing	Verify	Witness		
6.05	All testswill be done as per Technical specification.		Witness		specification	Verify	Witness		

STANDARD FIELD QUALITY PLAN FOR GALVANISED STRUCTURE														
Documents, Records identified with "Y" mark shall be included by supplier in QA documentation, A- Check by CIL Quality, P-Perform, V-Verify, W-Witness, H-Hold Point, S-Surveillance, IR-Inspection Report, TC-Test Certificate, RW-Representative Witness														
Sl.No	Component & Operation	Characteristic	Classifi- cation	Type of Check	Quantum of Check	Reference Documents	Acceptance norm	Record		Agency			Remarks	
								Format	Doc					
RECEIPT OF MATERIALS														
1	Check for manufacturer's name as per purchase order identification punch mark/details as per Test Report/ Delivery Challan	Compliance to purchase order specification	B	Visual	100%	100%	Delivery Challan	BOQ/ Packing List			Perform	Witness	Verify	
2	Check for CRN issued by Costomer/Construction/ALS TOM	Acceptance of Material	B	Visual	100%	100%	CRN	Document No to be Mentioned			Perform	Verify	Verify	
3	Check for Visual Damage/Cracks in Structure Materials etc	Transit Damage	B	Visual	100%	100%	No Damages	Contract Specification /approved drawing /Delivery challan		Y	Perform	Witness	Verify	
4	Check for Quality Size and Section of Member, Hardware, Nut & Bolts (MS/GI)etc	Quality Size and Section	B	Measure- ment	100%	100%	Drawing	List in Drawing & BOQ		Y	Perform	Witness	Witness	

5	Check for Structure Member as per Drawing	Compliance to Drawing	B	Measurement	100%	100%	Drawing	BOQ/ Packing List		Y	Perform	Verify	Verify	
6	Check for Damage of Galvanisation	Damage to Galvanized Coating & Finishing	A	Visual	100%	100%	Drawing	Smooth, uniform galvanized surface		Y	Perform	Witness	Witness	
STORAGE OF MATERIALS														
1	Check for Structurals stored on raised Platform to avoid direct contact with Ground/Moisture	Stored on raised Platform	B	Visual	Once in a Week	Once in a Week	Manufacturers Storage Instruction	As per Storage Procedure		Y	Perform	Witness	S	
2	Ensure that different members of materials are stored separately Size and Sectionwise labelled & tagged for easy identification with proper whether protection	Stacking/ Storing method, fixing of identification tags. Record keeping	B	Visual	Once in a Week	Once in a Week	Manufacturers Storage Instruction	As per Storage Procedure		Y	Perform	Witness	S	
INSTALLATION														
1	Check for structure members of various length and section, hardware, Nut & Bolts	Length and Section	B	Measurement	100%	100%	Erection Layout and Drawing	Contract Specification		Y	Perform	Witness	Verify	
2	Check for structure members Provided with Proper Match making	Structure Identification Numbers	A	Visual	100%	100%	Erection Layout and Drawing	Specified/Respective Standard drawings		Y	Perform	Witness	Witness	
3	Checks for Centrelines and spacing of holes/clamps/hocks provided as per layout/Foundation/structural drawing	Centrelines and spacing	B	Visual	100%	100%	Erection Layout and Drawing	Specified/Respective Standard drawings		Y	Perform	Verify	Verify	
4	Checks for size of nut bolts clamps & connectors and their level provided as per the drawing	Size & Level	B	Measurement	100%	100%	Erection Layout and Drawing	Specified/Respective Standard drawings		Y	Perform	Verify	Verify	
5	Check for height of the equipment mounted/electrical clearances maintained as per the approved drawing	Elevation /electrical clearance	A	Measurement	100%	100%	Erection Layout and Drawing	Specified/Respective Standard drawings		Y	Perform	Witness	Witness	

6	Checking of foundations & Foundation bolts structural members	Elevation foundation coordinates /spacing	A	Measurement	100%	100%	Erection Layout and Drawing	Specified/Respective Standard drawings		Y	Perform	Witness	Witness	
7	Bolts in Foundation	Bolt Height Pitch and diagonal	A	Measurement	100%	10%	Erection Layout and Drawing	Specified/Respective Standard drawings		Y	Perform	Witness	Witness	
8	Checking Approved Grouting Material	Compliance to Approval	B	Visual	100%	10%	Approved list	Approved list		Y	Perform	Verify	Verify	

Erection

1	Check for various members of structures assembled and joined with proper bolts, nuts as per approved drawing	Completion of work	B	Visual	100%	100%	Erection Layout and Drawing	IS:800 & IS:802		Y	Perform	Witness	Witness	
2	Check all the bolts are fixed with spring washer	Provision of spring washers	B	Visual	100%	10%	Drawing	Respective Standard		Y	Perform	Witness	RW	
3	Check for the bolts Properly tightened/grouted with quick setting cement after alignment of the structure	Tightness & Grouting	B	Physical verification by Torque wrench	100%	10%	Testing Procedure	CIL Approved Specification		Y	Perform	Witness	RW	
4	Check for double earthing of all equipment structure/ pole	Complete	A	Visual	100%	10%	Drawing	Respective Standard		Y	Perform	Witness	Witness	
5	Check for general arrangement and physical appearance of the structure, beams and columns	Elevation verticality twist & completion correctness	A	Visual	100%	100%	Drawing	±5mm, 1mm/m height or 15mm whichever less, 2mm/m or 6 mm whichever less. IS.802		Y	Perform	Witness	Witness	

6	Check for all shear edges of the parts from bolt centre with required clearance	Clearance	B	Measurement	100%	100%	Drawing	Standard drawings		Y	Perform	Witness	Witness	
7	Compare as built drawing with approved drawing	Deviation	A	Visual	100%	100%	Drawing	Drawing & Standard		Y	Perform	Witness	Verify	
Documents, Records identified with "Y" mark shall be included by supplier in QA documentation, A- Check by CIL Quality, H-Hold Point, S-Surveillance, IR-Inspection Report, TC-Test Certificate, RW-Representative Witness														
				Checked By	Approved By		Checked By	Received By	Approved By					

STANDARD FIELD QUALITY PLAN FOR STRINING WAVE TRAPE (WT)										
S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
	RECEIPT									
1	Check the transportation documents	Gate pass, Excise duty ,MDCC,LR	Visual	100%	Delivery Challan & Packing List	Availability	Verify	Verify		
	Check the technical documents	Check the Availability of Factory test report, catalogues and operation manual	Visual	100%	Packing List / BOQ	Availability	Verify			
	Physical inspection of material	Check for any physical damage.	Visual	100%			Verify	Verify		
		Check name plate details as per P.O	Visual	100%			Verify			
		Verify the case no. as per L.R.	Visual	100%	No damages & No leakage	No damage	Verify			
2	Qualification of Manpower	Hydra operator should have valid license.	Visual	100%	Certificate		Verify			
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate		Verify			

3	Unloading and storage	Ensure extra care to prevent damage on porcelain parts while unloading	Visual	100%	do		Verify			
		Ensure that equipment is not lifted or handled using primary terminals	Visual	100%	do		Verify			
		Ensure that the material is stored on raised wooden platform/ Planks to avoid direct contact with ground / Moisture .	Visual	Once in a month	Packing List / BOQ	Packing List / BOQ	Verify			
		Ensure that the material is stored in systematic manner for easy removal / Usage.	Visual	100%	do		Verify			
		Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification	Visual	100%	do		Verify			
		Ensure that all hardware are tagged & kept separately in racks/ in Bags size-wise for easy identification	Visual	100%	do		Verify			
		Ensure Tarpaulin covers have been provided if required .	Visual	100%	do		Verify			
		When stored in unpacked condition, store in such a way that the gauge glass is prevented from possible damage	Visual	100%	do		Verify			

4	Pre Installation	Check Matching of structure / PCD hole on WT, and mounting foundation	Visual	do	GA Drawings		Verify			
		Ensure that foundation for mounting the WT has been rigidly constructed.	Visual	do	Civil foundation Drg.		Verify			
		Check size & type of hardware / accessories required as per the drawing / BOQ	Visual	do	do		Verify			
		Ensure that no physical damage to WT body etc. is observed.	Visual	do	No Damages.		Witness			
		Ensure availability of necessary tools &, tackles, crane & sling for lifting of In. transformer etc.	Visual	do	Manufactures Manual		Verify			
5	Installation	Ensure that WT is always lifted using lifting hooks only etc.	Visual	do	Instruction Manual		Verify			
		Ensure that the WT is not tilted during lifting.	Visual	do	do		Verify			
		Ensure the orientation of primary and secondary terminals.	Visual	do	Erection Drawing		Verify			
		Check fixing nuts & bolts are properly tightened immediately after placement on the structure.	Visual	do	Manufactures Manual		Verify			

		Check that center line/vertical line of WT is correct.	Visual	do	do		Verify			
		Ensure fixing of accessories / loose supplied / Terminal Connector items if any.	Visual	do	Packing List		Verify			
		Ensure that touch up paint has been applied where ever peeled off.	Visual	do			Verify			
6	Testing	General Checks as per STR	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness		
		Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness		
		Ensure that complete site as built drawings/ documents alongwith test reports, reconciliation report, MTC, MIR have been handed over to projects/ engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness		
S.No.	Revision	Date	Legend	Contractor		Employer				
1										
2										
3										

STANDARD FIELD QUALITY PLAN FOR STRINING WORK

Standard Field Quality Plan for AI. CONDUCTOR

S.NO.	TITLE	CHARACTERISTICS/ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	Acceptance norms	Responsible Agencies		FORMAT OF RECORDS	REMARKS
							Contractor	Employer		
1	RECEIPT									
	Check the transpotation documents	Gate pass, Excise duty, MDCC,LR	Visual	100%	Delivery Challan & MDCC	Availability	Verify	Verify		
		Check for Manufacturer's name as per Delivery Challan.	Visual	100%	Delivery Challan & MDCC	Availability	Verify			
	Check the technical document	Check the Factory test report,GA drawing.	Visual		Delivery Challan & MDCC	Availability	Verify			
	Physical inspection of material	Check for Quantity and size of AL Conductor	Visual	100%	Packing List / BOQ	Availability	Verify			
		Verify the size and thickness of Conductor	Visual	100%	Packing List / BOQ	Packing List / BOQ	Verify			
		Verify the any kind of damage .	Visual	100%	Packing List / BOQ	No damage	Verify			
2	Qualification of Man power	Hydra operator should have license.	Visual	100%	Certificate	Availability	Verify			
		Fitter and Technician should be have relevant experience .	Visual	100%	Certificate	Availability	Verify			

3	Unloading and storage of materials	Ensure that the material is stored on raised wooden platform to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction manual /Standard engg. Practice	Availability	Verify	Verify		
		Ensure that the material is stored inside in systematic manner rating wise for easy removal.	Visual	100%	do	Availability	Verify			
		Ensure that different accessories / loose supply material are stored separately section and size wise labelled and tagged for easy identification.	Visual	100%	do	Availability	Verify			
4	Pre installation	Check the Stringing hardware as per drawing.	Visual	100%	GA Hardware drawing	GA Hardware drawing	Verify			
		Ensure that the Conductor free from cut and othe damage.	Visual	100%	No Damages.		Verify			
		Check the length and bends of Conductor as per drawing .	Visual	100%	GA Hardware drawing		Verify			
		Ensure availability of necessary tools &, tackles and insulator for lifting of Conductor.	Visual	100%	Instruction manual/ Standard engg. Practice	Instruction manual	Verify			
5	Installation	Ensure the Shifting of Conductor from lorry/ manually .	Visual	do	GA DRAWING		Verify			
		Ensure the Installation the Conductor with the help of Man Lift Or manually	Visual	do	GA DRAWING		Verify			

		Ensure the colour sleeve (R,Y,B) shall be used in Conductor.	Visual	do	GA DRAWING		Verify			
		Ensure the proper size of Conductor on the insulator or other equipment as per approved drawing .	Visual	do	GA DRAWING		Verify			
		Ensure the Conductor shall be properly tightened with the clamp and connector.	Visual	do	As per Instruction Manual		Verify			
6	Testing	General Checks as per SIR	Testing	100%	Instruction manual/ Standard engg. Practice	As per drawing	Verify	Witness		
		Routine Tests are as per Technical specification.	Testing	100%	specification		Verify	Witness		
		Ensure that complete site as built drawings/ documents alongwith test reports, reconciliation report, MTC, MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness		
S.No	Revision	Date	Legend	Contractor		Employer				
1										
2										
3										

STANDARD FIELD QUALITY PLAN FOR GIS

			Issued on :								
Name of document :- FQP GIS WORKS			Rev :								
Name of Client:-			Reference no:								
Name of project:-			Doc No:								
Name of Sub-contractor:-											
Standard Field Quality Plan for GIS											
S.NO.	TITLE	CHARACTERISTICS / ITEMS	TYPE OF CHECK	QUANTUM / FREQUENCY OF CHECK	REF. DOC & ACCEPTANCE STANDARD	Acceptance Norms	Responsible Agencies			FORMAT OF RECORDS	REMARKS
							Contractor	Consultant	Employer		
	RECEIPT OF MATERIALS										
1	Check the transportation documents	Gate pass, Excise duty, MDCC, LR etc.	Visual	100%	Delivery Challan & Packing List	Availability	Verify	Verify	Verify		
	Check the technical documents	Check the Availability of Factory test report , catalogues and operation manual.	Visual	100%	Packing List / BOQ	Availability	Verify	Verify			
	Physical inspection of material	Check for any physical damage.	Visual	100%	No damages		Verify	Verify			
		Check name plate details as per P.O	Visual	100%	Purchase order		Verify	Verify			
		Verify the case no. as per L.R.	Visual	100%	do		Verify	Verify			

2	Qualification of Man power	Hydra operator should have valid license.	Visual	100%	Certificate		Verify	Verify			
		Fitter and Technician should be have relevant experience	Visual	100%	Certificate		Verify	Verify			
3	Unloading and Storage	Each Crate/case has to be unloaded one by one only.	Visual	100%			Verify	Verify			
		Ensure hydra/Crane can be used for the unloading purpose and using marks provided on case.	Visual	100%			Verify	Verify			
		Ensure that the material is stored on raised wooden platform/ Planks to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction Mannaul / Standard engg. Practice		Verify	Verify			
		Ensure that the material is stored in a systematic manner rating wise for easy removal / usage.	Visual	do	do		Verify	Verify			
		Ensure that different accessories / loose supply material are stored separately ,section and size wise labelled and tagged for easy identification.	Visual	do	do		Verify	Verify			
		Ensure that all hardware are tagged & kept separately in racks / in bags,size-wise for easy identification.	Visual	do	do		Verify				
		Ensure the SF6 gas cylinders shall be stored in Cap intact condition(	Visual	do	do		Verify				

		provided for valve protection) with valve fully closed and free from explosive environment.									
		Ensure Tarpaulin covers have been provided if required .	Visual	do	do		Verify	Verify			
		Ensure while in storage , on no account water shall enter the equipment.	Visual	do	do		Verify	Verify			
		Ensure Cu tube and ferrule, nipple, and fitting etc. to be stored together inside the room.	Visual	do			Verify				
		Check when stored in unpack condition care shall be taken to Ensure match pole and mechanism are together.	Visual	do	do		Verify				
4	Pre Installation	Ensure that the foundation for mounting GIS cleared from civil works .	Visual	100%	Civil Construction clearance		Verify				
		Check size & type of hardware / Busbar coupling accessories required as per the drawing / BOQ	Visual	do	do		Verify				
		Ensure that no physical damage to GIS (CB,With & Without Earth Disconnectors, CT, PT and BUS BAR Enclosers) & GIB body etc.	Visual	do	NO Damages		Verify	Witness	Witness		

		Visual inspection shall be done after unpacking .	Visual	do			Verify	Witness			
		Ensure availability of proper foundation and structure.	Visual	do	GA Drawing		Verify				
		Check Matching of structure / Holes on GIS &GIB, and mounting foundation bolts	Visual	do	GA Drawing		Verify				
		Ensure availability of necessary tools &, tackles, crane/Hydra , sling for lifting of GIS & GIB,Sealer Anabond,Circlip plier,Bolts&nuts, derrick pipes, support, wire brush, emer sheet etc.	Visual	do	As per instruction Manual		Verify				
		Ensure the placement position of the phases and orientation of breaker on foundation.	Visual	do	Erection Drawings		Verify	Witness			
		Check for inspection agency stamp/punch.	visual	do			Verify				
		Ensure the availability of drawings.	Visual	do	Erection key diagram,scche matic diagram.		Verify				
5	Installation	Ensure the GIS shall be menimum pressure gas filled & checked by manufacturer.	Visual	100%	As per instruction Manual/ Test report	As per instruction Manual/ Test report	Verify	Verify	Witness		
		Ensure that GIS & GIB is always lifted using lifting hooks only and not from bushings etc.	Visual	100%	As per instruction Manual/ Test report	As per instruction Manual/ Test	Verify				

						report					
		Ensure that the GIS & GIB is not tilted during lifting.	Visual	do	do		Verify				
		Ensure to avoid giving jerk and the side seal does not hit anywhere	Visual	do	do		Verify				
		Check proper tightness of foundation nuts & bolts immediately after placement on the structure .	Visual	do	do		Verify	Witness			
		Check that center line and verticality of GIS & GIB is correct and horizontal leveling.	Visual	do	do		Verify	Witness			
		Ensure once the links are attached, shall be tighten firmly with nuts and lock clips.	Visual	do	do		Verify				
		Ensure not to temper with the valve at any stage.	Visual	do	do		Verify				
		Check for mechanical indication to show open & close position .	Visual	do	do		Verify				
		Ensure fixing of accessories / loose supplied items if any.	Visual	do	do		Verify				
		Ensure top & bottom terminations and earthing connection to earth are done using correct size of lugs /strips / Connectors.	Visual	do	do		Verify				
		Ensure that touch up paint has been applied where ever peeled off.	Visual	do	do		Verify				
		Check the wiring diagram make the required connections	Visual	do	do		Verify	Witness			
		Check for any loose connections	Visual	do	do		Verify				
		Ensure to clean the joint surfaces of the the terminal adaptor with wire brush or emery sheet.	Visual	do	do		Verify				

6	Testing		General checks as per STR.	Visual	100%	As per instruction Manual	Availability	Verify	Witness	Witness		
			Routine Tests are as per IEC/BIS/Technical specification.	Testing	100%	Specification	Availability	Verify	Witness	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report,MTC,MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness	Witness		
S.No.	Revision	Date	Legend	Contract or	Consultant	Employer	Client					
1												
2												
3												

STANDARD FIELD QUALITY PLAN FOR NIFPS (Nitrogen injection fire protection system)											
Name of Client:- HPSEBL											
SL.NO.	TITLE	CHARACTERISTICS /ITEM	TYPE OF CHECK	QUANTUM/ FREQUENCY OF CHECK	REF. DOC. & ACCEPTANCE STANDARD	ACCEPTANCE NORMS	RESPONSIBLE AGENCIES			FORMAT OF RECORDS	REMARKS
							Contractor	Consultant	Employer		
1	RECEIPT										
	Transpotation Documents	Gate pass, Excise duty ,DI,LR.	Visual	100%	Packing list	Packing list	Verify	Verify	Verify		
		Check for Manufacturer's name as per Delivery Challan	Visual	100%	Packing list	Packing list	Verify				
	Technical documents	Check the Factory test report,scheme drawing and GA drawing	Visual	100%	DI/Delivery Challan	DI/Delivery Challan	Verify				
	Physical inspection of material	Check supply of accessories / Loose supply items (if any)	Visual	do	Packing List	Availability	Verify				
		Visual examination for damage and Availability of gasket.	Visual	do	No Damage	Availability	Verify	Verify	Verify		

2	Qualification of Man power	Hydra operator should have license.	Visual	100%	Certificate	Availability	Verify				
		Fitter and Technician should be have relevant experience.	Visual	100%	Certificate	Availability	Verify				
3	Unloading and Storage	Ensure that the material is stored inside on raised wooden platform to avoid direct contact with ground / Moisture .	Visual	Once in a month	Instruction Mannaul / Standard engg. Practice	Availability	Verify	Verify	Verify		
		Unloading and Storage of materials Should be done as per Supplier Manual and Instruction.	Visual	do	Instruction Mannaul / Standard engg. Practice	Instruction Mannaul / Standard engg. Practice	Verify	Verify			
		Ensure that the material is stored in systematic manner for easy removal.	Visual	do	do	Availability	Verify				
		Ensure that different accessories / loose supply material are stored separate section and size wise labelled and tagged for easy identification.	Visual	do	do	Availability	Verify				
		Ensure that all hardware are tagged & kept separately in racks,size-wise for easy identification	Visual	do	do		Verify				

4	Pre Installation	Ensure that the foundation for mounting for NIFPS Panels have been rigidly constructed & cleared from civil end.	Visual	100%	GA Drawing/Civil drawing		Verify				
		Check the proper foundation/floor cut outs as per GA drawing.	Visual	100%	GA Drawing/Civil drawing for floor cut outs.		Verify				
		Ensure the availability of necessary tools & tackles, crane/Hydra & sling for lifting of NIFPS panels.	Visual	100%			Verify				
		Ensure that there is no physical damage to the NIFPS panels while shifting for erection.	Visual	100%			Verify	Verify	Verify		
5	Installation	Ensure that the NIFPS Materials are correctly positioned in the rack.	Visual	100%	GA drawing		Verify				
		Ensure that there is no damage to the NIFPS Materials Body during erection.	Visual	100%	GA drawing		Verify	Witness			
		Ensure that all the Connecting Pipes from NIFPS panel to Transformer Body which are fitted or not.	Visual	100%	Manufacturer Erection manual/ Drawing.		Verify				
		After complete installation of the Pipes, Pipe Supports,	Visual	100%	Manufacturer Erection manual/		Verify				

			Valves, Expansion Belows are properly connected.			Drawing.						
			Check the operations of all electrical inter- locks if any.	Visual	100%	Circuit Diagram		Verify				
			Check the earthing connections.	Visual	100%	GA drawing		Verify	Witness			
			Check the settings of the protection circuits & protective relay's operation.	Visual	100%	Manufacturer Instruction manual/ Relay setting data		Verify				
6	Testing		General Checks as per STR	Testing	100%	Instruction manual	As per drawing	Verify	Witness	Witness		
			Routine Tests are as per Technical specification.	Testing	100%	Specification	Availability	Verify	Witness	Witness		
			Ensure that complete site as built drawings / documents alongwith test reports, reconciliation report, MTC, MIR have been handed over to projects / engineering & receipt obtained.	Visual	100%	Schematic drawing.	Availability	Verify	Witness	Witness		
S. NO.	Revision	Date	Legend	Contractor	Consultant	Employer						
1												
2												
3												

CHAPTER- 16

FIELD QUALITY PLAN / GUIDE LINES FOR CONSTRUCTION OF OVER HEAD HT/ LT LINES

Main Points should be look after for Overhead Line Installation:

Overhead lines:

- The general precautions during storage and handling of shall be taken in accordance with relevant IS code.
- While laying the conductor shall be taken from top of the drum and the repeated in the direction of arrow on it.. Care shall be taken to avoid contact with steel works, fence, etc by giving soft wood protection, using wooden rollers.
- Proper tools shall be used during stringing work. During stringing operation standard sag table or chart shall be followed and care shall be taken to ensure that there are no kinks in the conductor. Joints in conductors shall be staggered. Mid span joints in conductors shall be avoided.
- After stringing the conductor, it shall be clamped permanently with shackle or strain clamps. An angle or section shall be selected while pulling up conductors.

Jumpers:

- While stringing, sufficient length shall of conductors be kept at shackle terminations for making jumpers. Jumpers shall be neat and as far as possible symmetrical to run of conductors. These shall be made to prevent occurrence of faults due to wind or birds. PG clamps may be preferred to binding of conductors at jumper location or service taps.

Cross Arms :

- The cross arms shall be made of MS Structural steel. The length of cross arms shall be suitable for accommodating the number of insulators on them with spacing of conductor. A gap of minimum 50 mm shall be left from the center of pin hole to end of cross arm on either side. The cross arm shall be complete with pole clamp made of MS flat of size not less than 50 x 6 mm with necessary nuts, bolts, washers, etc. The length of cross arm for carrying guard wires shall always run not less than 300 mm beyond outer most bare conductor of configuration.
- Cross arms shall be properly clamped to the support taking into consideration the orientation of lines.

Porcelain insulators and fittings:

- The porcelain insulators shall be confirming to IS 731 – 1971 for overhead lines. This shall be glazed, crack / burr free.
- The insulator shall have adequate mechanical strength, high degree of resistance to electrical puncture and resistance to climatic and atmospheric attack.

- All iron parts shall be hot dip galvanized & all joints shall be airtight. Pin insulators / shackle insulators / disc insulators shall be erected on cross arms and 'D' iron clamp shall be used or as specified by Engineer-in-charge. Shackle insulators shall be used in conjunction with 'D' iron clamps when configuration of conductor is vertical.
- These shall also be erected on cross arm at intermediate support in case of long lines, deviation from straight lines. Care shall be taken that insulators are not damaged during erection.

Binding material:

- Binding of conductor with the insulator shall be done with soft aluminum wire / conductor. The binding of conductor to insulator shall be sufficiently firm and tight to ensure that no intermittent contact develops. The end of binding wire shall be tightly twisted in close spaced spiral around the conductor to ensure good electrical contact and strengthen the conductor.

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Supports and spacing of poles:

- Support of overhead line shall be of adequate strength confirming in all respects to rules 76 of Indian electricity rules.
- Pole spacing and clearance between lowest conductor above the ground level across / along the street shall be in accordance with rule 85 of Indian electricity rules. Suitable foundation shall be provided for erection of poles.
- The foundation shall include excavation in all types of soil and rocks and back filling, RCC, reinforcement, formwork.
- Excavation for foundations for poles / stay / strut : After the location of supports / stay are pegged accurately, the excavation work shall be taken up and care should be taken while excavating that pits are not oversized.
- The pit should be excavated in the direction of the line. The depth and size of pit shall be such that normally 1/6th of the length of pole is buried in the ground and suitable for foundation of support.
- For stay the position of pit shall normally be such stay makes as large an angle as possible with the support and it shall be in the range of 40 to 60 degrees.
- The length of stay rod shall project 450 mm above the ground level. The pit for strut shall be located at a distance not less than 1.8M from the pole.
- The depth of pit shall be such that at least 1.2M of the strut is buried in the ground.

Stay / strut:

- Stay set shall consist of stay rod, anchor plate, bow tightened / turn buckle, thimbles, stay wire and stain insulators.
- The stay rod shall be with stay grip in case of turn buckle is used instead of bow tightened. The entire stay set assembly shall be galvanized. The stay wire shall be either 7/4.0 mm diameter or 7/3.15 mm diameter GI having tensile strength of not less than 70 kgf/sq mm and confirming to IS 2141. T
- The anchor plate shall be of MS galvanized and not less than 300 mm x 300 mm x 6.4 mm thick. The stay rod / buckle rods shall be minimum 16/19 mm diameter galvanized steel rod having tensile strength not less than 42 kgf/sq mm. Minimum length of stay rod and buckle shall be 1800 mm and 450 mm respectively.

Erection stay sets:

- The anchor plate shall be galvanized MS plate. The stay rod with anchor plate shall be embedded in cement concrete 1:3:6. A stay shall be provided at all angle and terminal poles. Double stay shall be provided at all dead ends and in such case, these shall be as far as possible to be set parallel to each other.

Cage guard:

- All metal supports of overhead lines and metallic fitting attached shall be permanently and effectively earthed. Cage guard / cradle guard shall be made of 6 SWG GI wire confirming to IS 2633 including netting, stretching and jointing of cage and lacing by 10/12 SWG GI wire, binding by 14/16 SWG GI wire.

Danger boards:

- All supports carrying HV lines shall be fitted with danger plates confirming to IS 2551 at height of 3 M from ground indicating the voltage of line. The script shall be both in 'English/Hindi'.

Anti climbing devices:

- Necessary arrangement for preventing unauthorized persons from ascending any of the supports and structure carrying HV lines without the aid of ladder or special appliance shall be made.
- Unless otherwise specified barbed wire confirming to IS 278 having four points barbed spaced 75 +/- 12 mm apart shall be wrapped helically with a pitch of 75 mm around the limb of support and firmly commencing from the height of 3.5 M and up to 5 or 6 M as directed by the engineer.

Lightning arrestor:

- Lightning arrestor suitable for HT lines shall be installed one unit per phase at terminations, transformer stations, etc.
- The devices shall be connected ahead of fuse provided if any. Independent earth electrode shall be provided for LA.

- The earth lead from earth electrode to LA shall be continuous. The LA shall conform to IS 3070 and shall be non linear distribution class.
- The LA shall be non-linear type, distribution class, outdoor type suitable for effectively earthed system. The LA shall consist of line terminal stud, earth terminal stud, number of spark gaps in series with non-linear resistor, the whole assembly housed inside a hermetically sealed porcelain bushing.
- Neoprene rubber gasket shall be provided between metal caps and porcelain bushing. Non-linear resistor shall be silicon carbide blocks metalized at both ends to ensure good electrical contact between terminals, non-linear resistor & spark gaps.
- Mounting bracket shall be hot dip galvanized suitable for mounting LA on structure.

Cable Laying Direct in Ground:

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- The method shall be adopted where the cable route is through open country, along road / lanes, etc and where no frequent excavations are encountered and re excavation is possible without affecting other work.

Width of trenches:

- The width of trench for laying single cable shall be 35 cm Where more than one cable are to be laid in the same trench in horizontal formation, width of trench shall be increased such that the inter-axial spacing between the cables for 415 volts shall be 20 cm and for 11 shall be 35 cm.

Depth of trenches:

- Where cables are laid in single formation, the total depth of trench shall not be less than 75 cm for cable up to 1.1 KV grade and shall not be less than 120 cm for cable above 1.1 KV grade. Wherever more than one tier formation is unavoidable and vertical formation is adopted, the depth of trench shall be increased by 30 cm for each additional tier to be formed.

Protective covering:

- Cable laid in trenches shall have covering of clean dry sand not less than 170 mm above the base cushion of sand before the protective cover is laid.
- The cables shall be protected by B class/second class brick of not less than 20 cm x 10 cm x 10 cm or protective cover placed on top of the sand and both sides of cable for full length of the cable to the satisfaction of Engineer-in-charge.

Back filling:

- The trenches shall be back filled with excavated earth free from stones or other scrap edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 300 mm unless otherwise specified.

Route marker:

- Route marker shall be provided along straight runs of cables and at points of change in direction as approved by Engineer-in-charge and in general at intervals not exceeding 100 meters in straight run. Route marker shall be made out of 100 mm x 100 mm x 5 mm GI/Al plate bolted or welded on 35 mm x 35 mm x 6 mm MS angle iron of 600 mm long.
- Such route markers shall be mounted and grouted parallel to and 0.5 meter away from the side of trench. The work “cable” with voltage grading and size of cable shall be inscribed on the marker.

FIELD QUALITY PLAN- CONDUCTOR, EARTH WIRE & AB CABLE ERECTION (HT & LT)

Item: CONDUCTOR, EARTH WIRE & AB CABLE (HT & LT)

SYSTEM: CONDUCTOR, EARTH WIRE & AB CABLE

SUB-SYSTEM: 1 CONDUCTOR(AAAC,AAC,ACSR) ERECTION

SL.NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OFCHECK Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
1	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL CHECK	100%	DELIVERY CHLLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHLLAN/MDCC DESCRIPTIONS	STORES REGISTER	COMPONENETS WHICH ARE INSPECTED AND CLEARED BY PIA (Project Implementation Agency) SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL CHECK	100%		DRUMS FOUND DAMAGED DURING TRANSIT ARE STACKED SEPARATELY	STORES REGISTER	
		3) STORAGE	C	VISUAL CHECK	100%	STANDARD PRACTICE	DRUMS ARE STORED ON HARD SURFACE AREA	STORES REGISTER	
2	ERECTION OF CONDUCTOR	1) HAN- DLING OF THE CONDUCTOR	C	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	CONDUCTOR SHOULD NOT BE DRAGGED ON THE GROUND		SCRATCHES OR DAMAGES TO THE STRANDS WOULD OCCUR IF NOT HANDLED PROP- ERLY
		2) SE- QUENCE OF CONDUCTOR EREC- TION	C	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	SEQUENCE OF RUNNING OUT SHALL BE FROM TOP TO BOTTOM, i.e.. THE TOP CONDUCTOR SHALL RUN OUT FIRST, FOLLOWED BY THE SIDE CONDUCTORS		

SL.NO	MAIN ACTIVITY& OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK Engineer-in- Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		3) STRING- ING OF THE CONDUCT- TORS	C	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	ANY DAMAGES TO THE STRANDS SHALL BE RE- PAIRED WITH REPAIR SLEEVES		
		4) MID SPAN JOINTING	B	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	COMPRESSION TYPE NOT MORE ONE JOINT PER SUB CONDUCTOR PER SPAN		ALL JOINTS AND SPLICES SHOULD BE 15 METERS AWAY FROM THE POLE
		5) BIND- ING THE CONDUCT- TOR TO THE INSULATOR	C	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	AS PER THE REC SPECIFICA- TIONS		
		6) EREC- TION AT ROAD CROSSINGS	B	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	GUARDING SHALL BE PRO- VIDED AT MAJOR CROSS- INGS		THE GROUND CLEARANCES AT ROAD CROSS- INGS SHALL BE AS PER RELEVANT IE RULES
		7) ANTI- CLIMBLING DEVICES	B	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	APPROVED DRAWINGS		

SL.NO	MAIN ACTIVITY& OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OFCHECK - Engineer-in- Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		8) DANGER BOARDS	B	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	APPROVED DRAWINGS		
3	TENSIO N- ING AND SAGGIN G	1) MEA- SUREMENT OF SAG- GING	B	VISUAL	100%	AS PER SAG- TENSION CHARTS	AS PER IE NORMS		TENSIONING AND SAGGNG OPERA- TIONS ARE CARRIED IN CALM WEATHER, WHEN RAPID CHANG- ES IN TEMPERATURE ARE NOT LIKELY TO OCCUR
4	CLIPPING	1) CLIPPING THE CON- DUCTOR IN POSITION	C	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	MANUFACTURER'S RECOMMENDATION		
		2) JUMP- ERING AT SECTION AND ANGLE TOWERS	C	VISUAL	100%	UTILITY SPEC- IFICATION or AS PER ACCEPTANCE NORMS	JUMPERS FORMED TO PARABOLIC SHAPE		TO ENSURE MAXI- MUM CLEARANCE TO EQUIPMENT

SL.NO	MAIN ACTIVITY& OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFER- ENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
4	RECEIPT AND STOR- AGE	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHLLAN/ MDCC	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHLLAN/ MDCC DESCRIPTIONS	STORES REGISTER	COMPONENETS WHICH ARE INSPECTED AND CLEARED BY PIA SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%		DRUMS FOUND DAM- AGED DURING TRANSIT ARE STACKED SEPA- RATELY	STORES REGISTER	
		3) STORAGE	C	VISUAL	100%	STANDARD PRACTICE	DRUMS ARE STORED ON HARD SURFACEAREA	STORES REGISTER	
5	FIXING OF EYE HOOK AND SUS- PENSION / DEAD END CLAMPS	A)EYE HOOK WITH POLE THROUGH BOLT							
		1) CHECK THE THREAD- INGS OVER THE THROUGH BOLT	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGIS- TER	
		2) FIX THE THROUGH BOLT INTO THEPOLE	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	APPROVED DRAWING	SITE REGIS- TER	

S.NO	MAIN ACTIVITY & OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFER- ENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		3) CHECK THE ALIGN- MENT OF BOLT WITH THE POLE	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGIS- TER	
		B) EYE HOOK WITH EYE HOOK CLAMP							
		1) CHECK THE DIMEN- SIONS OF THE CLAMP AND FIX THE CLAMP TO THE POLE	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGIS- TER	
		2) CHECK THE ALIGN- MENT OF CLAMP WITH THE POLE	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGIS- TER	THE CLAMP SHOULD BE EXACTLY PERPENDICU- LAR TO POLE
		C) CHECK THE ALIGN- MENT OF THE EYE HOOKS ALONG THE LINE	C	VISUAL	100%	STANDARD PRACTICE	HOOKS SHALL BE ERECTED AT SAME ELEVATION	SITE REGIS- TER	WHERE EVER HOOKS ARE MISALIGNED THERE SHOULD BE REPLACED BEFORE CONDUCT RING

S.NO	MAIN ACTIVITY& OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OFCHECK - Engineer- in-Charge	REFER- ENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		D) FIXING OF SUS- PENSION CLAMS / DEAD END CLAMPS	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGIS- TER	
6	ERECTION OF CABLE	1) HAN- DLING OF THE CABLE	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	CABLE SHOULD be care- fully handled to avoid any damage		CABLE SURFACE SHALL BE FREE FROM FAULTS, FLAWS e.t.c
		2) SE- QUENCE OF CABLE ERECTION	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	SEQUENCE OF RUN- NING OUT SHALL BE FROM TOP TO BOTTOM, i.e.. THE TOP CABLE SHALL RUN OUT FIRST, FOLLOWED BY THE SIDE CABLES		
		3) FIX THE MESSEN- GER WIRE OF AB CABLE TO CLAMPS (SUSPEN- SION/ DEAD END CLAMP)	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	PIA SPECIFICATION/ AS PER APPROVED DRAW- ING		
		4) CHECK THE TIGHT- NESS OF CABLE WITH CLAMPS	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	AS PER THE STANDARD PRACTICE		

SL.NO	MAIN ACTIVITY& OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OFCHECK Engineer-in- Charge	REFER- ENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		5) CHECK THE GROUND CLEARANC- ES AFTER ERECTION OF THE AB CABLE	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	AS PER IE RULES		THE MINIMUM GROUND CLEARANCES SHOULD BE MAINTAINED
7	RECEIPT AND STOR- AGE	1) RECEIPT AT STORES	C	VISUAL CHECK	100%	DELIVERY CHLLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHLLAN	STORES REGISTER	COMPONENETS WHICH ARE INSPECTED AND CLEARED BY PIA SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL CHECK	100%		THE SURFACE OF EARTH WIRE SHOULD BE FREE FROM FLAWS AND DUST	STORES REGISTER	
		3) STORAGE	C	VISUAL CHECK	100%	STANDARD PRACTICE	EARTH WIRE SHOULD BE STORED IN DRY AREAS	STORES REGISTER	
8	ERECTION OF EARTH WIRE	1) HAN- DLING OF THE EARTH WIRE	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	Earth Wire should be care- fully handled to avoid any damage		SCRATCHES OR DAM- AGES TO THE SURFACE WOULD OCCUR IF NOT HANDLED PROPERLY

SL.NO	MAIN ACTIVITY& OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFER- ENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		2) EREC- TION OF EARTH KNOB	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	SEQUENCE OF RUNNING OUT SHALL BE FROM TOP TO BOTTOM,i.e. THE TOP EARTH WIRE SHALL RUN OUT FIRST, FOLLOWED BY THE SIDE EARTH WIRES		CHECK THE CLEARANCE BETWEEN EARTH KNOB AND PIN INSULATORS AND THE COMPONENTS SHALL BE ERECTED AS PER DRAWING AND AS PER SPEC
		3) STRING- ING OF THE EARTH WIRES	C	VISUAL	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	ALL JOINTS SHALL BE COMPRESSION TYPE		GROUND CLEARANCES SHOULD BE MAINTAINED
CLASS OF CHECK: A -- CRITICAL B -- MAJOR C-- MINOR									

Cables								
Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Site Incharge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
1	RECEIPT & STORAGE							
1.1	Receiving inspection (Completeness of documents, test certificates, etc.)	V	-	B	100%	Delivery Challan	MRC	
1.2	Unloading	V	-	B	100%	Instruction Manual	-	
1.3	Visual examination	V	-	B	100%	Packing list / Instruction Manual	-	
1.4	Proper storage	V	-	B	100%	Instruction Manual/ IS: 1255	-	
1.5	End Sealing (Cable ends are sealed by PVC cap to avoid ingress of moisture)	V	-	B	100%	IS: 1255	Site Record	
2	PRE INSTALLATION							
2.1	Unloading of Drums							
A	Check for drum mounting - cable wheel/ jack	V	-	B	100%	IS: 1255	Site Record	
B	Check for cable unwinding - cable wheel/ jack	V	-	B	100%	IS: 1255	Site Record	
C	Check for proper unrolling - Cable Wheel/ Jack	V	-	B	100%	IS: 1255	Site Record	
D	Check for cable end sealing	V	-	B	100%	IS: 1255	Site Record	
2.2	Availability of bricks at site for buried cables	V	-	C	100%		Site Record	
2.3	Excavation of trench for U/G cable laying	V	-	C	100%	UTILITY SPECIFICATION or AS PER ACCEPTANCE NORMS	Site Record	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Site Incharge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
2.4	Sand Cushioning for buried cables	V	-	C	100%		Site Record	
2.5	Ascertaining cable route and length	V	-	B	100%	Cable Route	Site Record	
2.6	Conformity with cable schedule	V	-	B	100%	Cable Schedule	Site Record	
2.7	Insulation resistance checking - Meggar (500 V for LT & 1000V for Cables upto 11kV)	Electrical	Meggar	A	100%	IS: 1255	Site Record	
2.8	Proper route maintaining during cable laying	V	-	B	100%	Cable Route	Site Record	
2.9	identification and dressing of cables	V	-	B	100%	standard Practice	Site Record	
2.10	Use of trefoil clamps for single core cables	V	-	B	100%	standard Practice	Site Record	
2.11	Proper verticality of multicore cables	V	-	B	100%	standard Practice	Site Record	
3	INSTALLATION							
3.1	Removal of wooden planks from cable drum	V	-	B	100%	UTILITY SPECIFICATION or AS PER ACCEPTANCE NORMS	-	
3.2	Check cable is not dragged on hard ground	V	-	B	100%	UTILITY SPECIFICATION or AS PER ACCEPTANCE NORMS	-	
3.3	Check size of cable & cutting of cable length	V	-	B	100%	UTILITY SPECIFICATION or AS PER ACCEPTANCE NORMS	-	
3.4	Check the separation between different types of cables laid nearby.	V	-	B	100%	UTILITY SPECIFICATION or AS PER ACCEPTANCE NORMS	-	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instru - ment s	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
3.5	Check the laying of cables as per cable schedule.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.6	Check the cable tray are earthed as per the drawing.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.7	Check the cable glands, lugs, ferrules, cable tag/ marker are provided as per requirement.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.8	Check the cable cable drum/ cable to be laid for any external damage.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.9	Check the availability and functionality of the rollers.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.10	Check there are no damage / twisting of cables during laying.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.11	Check that cables are protected from the sharp bends while laying.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.12	Check that the power cables are separated from the control cables.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.13	Check the phase matching at both end after each joint.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instru- ment s	Class	QUANTUM OF CHECK - Engineer-in- Charge	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
1	2	3	4	5	6	7	8	9
3.14	Check cable tags are provided at required intervals/required places and both end as per cable schedule.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.15	Check the cables are dressed, clamped and supported properly as per the drawing.	V	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	-	
3.16	Insulation Resistance Check	Electrical	Meggar	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	Site Record	
3.17	Check whether some extra length (1.5 mtr.) is kept in each cable run for future use	Physical	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	Site Record	
3.18	Check that all wall openings/ pipes/ sleeves are sealed to avoid seepage of water	Physical	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	Site Record	
3.19	check that buried cables are covered with sand layers and by protective bricks	Physical	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	Site Record	
3.20	Ensure that the location of underground cable joints are identified.	Physical	-	B	100%	UTILITY SPECIFICA- TION or AS PER AC- CEPTANCE NORMS	Site Record	

S.No.	Activity and Operation	Characteristics/ instruments	Class of Check	Type of Check	QUANTUM OF CHECK - Engineer-in-Charge	Reference Document	Acceptance Norms	Format of Records	Remarks
1	2	3	4	5	6	7	8	9	10
1.00	RECEIPT								
1.01	Main Unit	a) Physical damage & Oil leakage from valves/ flanges & other part of body	B	Visual	100%	No Physical damage & Leakage from valves/ flanges and other parts of main unit.			
1.02		b) Unloading with the help of lifting lugs & hydra on foundation or at suitable location in absence of foundation.	B	Physical	100%				
		c) Check S.No. & rating	B	Verify	100%	BBU No.			
1.03	Accessories/ Loose Items	a) Physical damage	B	Visual	100%	No Physical damage			
		b) Unloading of Marshalling Box, radiator, Conservator tank, Bucholz Relay, current transformer, MOG, PRD, Breather, Silica gel, terminal Connector & boxes.	B	Visual	100%				
		c) Leakage of oil from drums	B	Visual	100%	No leakage	Log Record		
1.04	Accessories/ Loose Items	d) All Packing cases are sealed/ packed with packing list	C	Visual	100% once	No opening/ break- ing of seal/ packing	Log Record		
		e) Verification of items as per packing list	C	Verify	100% once	No shortage	Log Record		
2.00	STORAGE								

S.No.	Activity and Operation	Characteristics/ instruments	Class of Check	Type of Check	QUANTUM OF CHECK - Engineer-in-Charge	Reference Docu- ment	Acceptan ce Norms	Format of Records	Remarks
1	2	3	4	5	6	7	8	9	10
2.01		a) Oil drums are placed at protected area & not stored on their side faces.	C	Physical	100% once	No leakage	Log Record		Surveillance check by NE-SCL Erection.
		b) All components/ equipment are stored at suitable location till they are used for erection.	C	Visual	100% once	....	Log Record		Surveillance check by NE-SCL Erection.
		c) Fitting of breather on main unit in case of long storage period.	C	Visual	100% once	....	Log Record		Surveillance check by NE-SCL Erection.
		d) All instruments such as MOG, PRD, silica gel, Marshalling Box, Breather, terminal connector, bucholz Relay, WTI, OTI, CT are stored indoor.	C	Physical	100% once	....	Log Record		Marshalling box are stored vertical in their respective cases.
		e) Flushing of radiators & pipes for missing blanks with oil and blanking of pipes and radiator ends.	B	Physical	100% once	No dirt should remain inside the pipe & radiators and blanking of pipe after cleaning/ flushing.			
		f) Radiators, Pipes and conservator tanks are stored at raised platform to avoid direct contact with water.	B	Physical	100% once	....		
3.00	ERECTION	Transformers							
3.01		a) Availability of tools and tackles	B	Visual	100%	....		
		b) Availability of transformer foundation as per drawing.	B	Visual	100%	....		

S.No.	Activity and Operation	Characteristics/ instruments	Class of Check	Type of Check	QUANTUM OF CHECK - Engineer-in- Charge	Reference Document	Acceptanc e Norms	Format of Records	Remarks
1	2	3	4	5	6	7	8	9	10
		c) Fixing and greasing of rollers with transformer for smooth shifting of main unit from storage area to site of erection.	B	Physical	100%	....		
		d) Shifting/ haulage of main unit from storage area upto foundation site with the help of hydra, ropes, pulleys etc.	B	Physical	100%	....		
		e) Installation of Transformer on its foundation	B	Visual	100%	....		
		f) Ensure radiators were in flushed condition before erection with main unit.	B	Visual	100%	....		
		g) mounting of pipes, radiators, explosion vent, cable box, earthing flat as per drawing.	B	Visual	100%	....		
		h) Availability of required capacity filtration machine and its healthiness.	B	Visual	100%	....		
		I) Prior to start of vacuum test, breakdown voltage of oil sample taken from separate tank in which oil is stored for filtration.	B	Test	100%	....		
		j) Drying out of transformer with complete assembly with help of machine.	B	Visual	100%	....		

S.No.	Activity and Operation	Characteristics/ instruments	Class of Check	Type of Check	QUANTUM OF CHECK - Engineer-in-Charge	Reference Document	Acceptance Norms	Format of Records	Remarks
1	2	3	4	5	6	7	8	9	10
		k) Oil filling in transformer under vacuum through filtration machine.	B	Test	100%	....		
		l) Testing of oil after completion of filtration.	B	Test	100%	....		
		m) Oil level & leakage in transformer tank, radiators.	B	Test	100%	....		
		n) Wiring and termination of cable from instrument, Bucholz Relay, OTI/WTI, MOG.	B	Physical	100%	....		
		o) Tap switch position	B	Physical	100%	....		
		p) Polarity and connection of CTs with leads, otherwise CTs secondary to be shorted.	B	Physical	100%	....		
		q) IR value between terminal and flange bushing.	B	Physical	100%	....		
		r) Earthing of Transformer as per drawing and IE rules.	B	Physical	100%	As per drawing			
		s) General appearance for paint condition. (Retouching of paint if required.)	B	Physical	100%	....		
		t) Whole assembly for tightness and general appearance.	B	Physical	100%	....		

FIELD QUALITY PLAN FOR CIVIL WORKS

1	DOCUMENTS AND DRAWING								
1.1	Check that the instruction manuals for all equipments have been received.		B	Physical	100%	Bill of Material		Office record	
1.2	Check that the approved civil foundation plan of equipment are available.		B	Physical	100%	Bill of Material		Office record	
2									
2.1	Earth Work								
2.1.1	Before excavation								
2.1.1.1	Check the pegs conditions as per line and alignment w.r.t. existing structure	Measure Tape	B	Visual	100%	As per site EIC	As per site EIC	Office record	
2.1.1.2	Checking of pit marking as per drawing.	Measure Tape	B	Visual	100%	Foundation plan	Foundation plan		
2.1.2									
2.1.2.1	Checking of pit marking / location	Measure Tape	B	Physical	100%	Foundation Plan	Foundation Plan	Site record	
2.1.2.2	Check the dimension of pit at bottom (Lx Bx D)	Measure Tape	B	Physical	100%	Foundation Plan	Foundation Plan	Site record	
2.1.2.3	Check the type of soil, if BC soil is confirmed follow the instruction on drawing for stone soling	Measure Tape	B	Physical/ Hammering crobar	100%	Foundation Plan	Foundation Plan	Site record	

Sr. No.	ACTIVITY AND OPERATION	Characteristics / Instruments	Class of Check	Type of Check	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents	Acceptance Norms	“Format Of Records”	Remarks
2.1.2.4	Check the type of soil, if Non BC soil is confirmed follow the drawing.	Measure Tape	B	Physical/ Hammering crobar	100%	Foundation Plan	Foundation Plan	Site record	
2.3	Shuttering								
2.3.1	Check the shuttering board which are made to shape with steel tape including cleaning & proper surface preparation .	Measure tape	B	Visual	100%	Foundation Plan	Foundation Plan	Site record	
2.3.2	Placment of shuttering boards including supports, tie rod etc.	Tackling equip-ment	B	Visual	100%	Foundation Plan	Foundation Plan	Site record	Required as per site condition
2.3.3	Measurement, line and level with steel tape & water level.	Steel tape & water level	B	Visual	100%	Foundation Plan	Foundation Plan	Site record	
2.3.4	Check placement, alignment & embedment of anchor bolts, Check no oil on inserts (For foundation bolts)	Measure tape	B	Visual	100%	Foundation Plan	Foundation Plan	Site record	
2.3.5	Check bolt setting with templates.	Measure tape	B	Visual	100%	Foundation Plan	Foundation Plan	Site record	
2.4	Cement								
2.4.1	Cement - Received from Sup- plier	Review of TC/ As per IS	A	Visual	One of con- signment	IS: 11269	Manufacturer's Test Certificate	Site Record	
2.4.2	Setting Time & Compressive strength	Review of TC/ As per IS	A	Visual	One of con- signment	IS: 11269	Manufacturer's Test Certificate	Site Record	
2.5	Reinforced Steel								
2.5.1	Visual Examination to ensure free from cracks, surface flaws, imperfect edges and dimen- sional checks		B	Visual	100%	IS: 1786 & Approved Drawings	Approved Draw- ings	Site Record	

Sr. No.	ACTIVITY AND OPERATION	Characteristics / Instruments	Class of Check	Type of Check	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents	Acceptance Norms	"Format Of Records"	Remarks
2.5.2	Cutting, Bending, placing of reinforced steel bars & lapping	Tackling Equip-ment	B	Visual	100%	Approved Drawings	Approved Draw-ings	Site Record	
2.6	Concreting								
2.6.1	Mixing of cement (OPC, 53 Grade, ISI mark), sand & coarse aggregate as per ratio 1:4:8/1:2:4/1:5:8/1:1.5:3	Tackling equip-ment	B	Visual	100%	As per instructions of manufacturer's	As per instructions of manufacturer's	Site record	
2.6.2	Check workability of concrete	Tackling equip-ment	B	Visual	100%	As per instructions of manufacturer's	As per instructions of manufacturer's	Site record	
2.6.3	Placing concrete, poking and compacting.	Tackling equip-ment	B	Visual	100%	As per instructions of manufacturer's	As per instructions of manufacturer's	Site record	
2.6.4	Testing of concrete cubes for compression strength. 7 Days or 28 Days.	Compression machine	A	Third party lab test	One set per substation	IS456, IS516	IS 456, IS 516	Site record	
2.6.5	Check whether curing period of the foundation is completed.		C	Visual	100%	Visual check for min 7 days	Visual check for min 7 days	Site record	
2.6.6	Check the backfilling and compaction is completed upto ground level.	Tackling equip-ment	A	Visual	100%	Foundation Plan	Foundation Plan	Site record	
2.7	Masonry work								
2.7.1	Check the proportion, mixing & placement of mortar.	Tackling equip-ment	B	Visual	Random	Foundation Plan	Foundation Plan	Site record	
2.7.2	Plumb & alignment	Tackling equip-ment	B	Visual	Random	Foundation Plan	Foundation Plan		
2.7.3	Curing		B	Visual	100%	Visual check for min 7 days	Visual check for min 7 days	Site record	

Sr. No.	ACTIVITY AND OPERATION	Characteristics / Instruments	Class of Check	Type of Check	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents	Acceptance Norms	"Format Of Records"	Remarks
2.7.4	Control brick height " In day work"	Measure tape	B	Visual	100%	Foundation Plan	Foundation Plan		
2.8	Plastering work								
2.8.1	Plastering thickness and even- ness		B	Visual	Random	Visual check	Visual check		
2.8.2	Mortar mix / proportion	Tackling equip- ment	B	Visual	Random	Foundation Plan	Foundation Plan	Site record	
2.8.3	Check the placement, thickness of plaster, line & level of plaster	Tackling equip- ment	B	Visual	Random	Foundation Plan	Foundation Plan	Site record	
2.8.4	Curing		B	Visual	100%	Visual check for min 7 days	Visual check for min 7 days	Site record	
<p>Legends :</p> <p>"CLASS OF CHECK:</p> <p>A -- CRITICAL -- TO BE WITNESSED BY PIA SITE AND SURVEILLANCE BY PIA, CC. B-- MAJOR -- TO BE WITNESSED BY CONTRACTOR AND PIA SITE</p> <p>C-- MINOR -- TO BE WITNESSED BY CONTRACTOR AND ENGINEER IN CHARGE"</p> <p>TC : Test Certificate</p> <p>V : Verify</p> <p>W : Witness</p> <p>EIC : Engineer In Charge</p>									

FIELD QUALITY PLAN-- PSC POLES (11KV& LT), POLE EARTHING AND GUY ERECTION									
Item: PSCC Poles(11KV& LT)									
Sub-system: POLE ERECTION ,EARTHING, GUY ERECTION									
								PAGE:	
SL.NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
1	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL	100%	SUPPLIER TC	CORRELATION OF THE LOT RECEIVED WITH THE TC	SUPPLIER TC	POLES WHICH ARE INSPECTED AND CLEARED BY PIA SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%		BROKEN, DAMAGED POLES SHALL BE STACKED SEPARATELY	SITE REGISTER	
		3) PROPER STORAGE	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	"1)POLES SHALL BE STACKED IN SUCH A MANNER THAT BROAD SIDE IS VERTICAL. 2)EACH TIER IN THE STACK IS SUPPORTED ON WOODEN SLEEPERS LOCATED AT 1.2Mtr APART, WOODEN SUPPORTS ALIGNED IN VERTICAL LINE."	SITE REGISTER	

SL.NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
2	TRANSPORTATION OF POLES	TRANSPORTATION	C	VISUAL	100%	UTILITY SPECIFICATION or AS PER ACCEPTANCE NORMS	"1)POLES SHALL BE TRANSPORTED WITH BROAD FACES PLACED VERTICALLY 2)SUPPORTS ARE LOCATED AT 1.2mtr APART THROUGHOUT THE LENGTH OF THE POLE"		
3	PRE INSTALLATION	AVAILABILITY OF APPROVED DRAWINGS ALL CONSTRUCTIONAL MATERIAL.	C	VISUAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	"1)ENSURE APPROVED DRAWINGS FOR INSTALLATION OF THE POLES ARE AVAILABLE AT WORK PLACE 2)ENSURE ALL CONSTRUCTION MATERIAL LIKE BOULDERS, SAND , CEMENT , STONE CHIPS ARE ALSO AVAILABLE ATWORK PLACE "	SITE REGISTER	
		AVAILABILITY OF ROUTE SURVEY MAP AT WORK PLACE	C	VISUAL	100%	ROUTE SURVEY REPORT		SITE REGISTER	
4.INSALATION OF POLES									
4.1	EXCAVATION OF PIT	4.1.1) MANUAL EXCAVATION / CONTROLLED BLASTING	C	VISUAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	PIT LONGITUDINAL AXIS SHOULD BE IN THE DIRECTION OF THE LINE	SITE REGISTER	"CONTROLLED BLASTING IS PERMITTED IN CASE OF HARD OR ROCKY SOILS (IN CASE OF INHABITED LOCATION DRILLING/ CHIPPING TO BE RESORTED TO)"

SL.NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		4.1.2)SIZE OF PIT	C	DIMENSIONAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	0.6M X 1.2M (OR) 0.6Dia X 1.5M Depth	SITE REGISTER	IN HARD ROCK LOCATIONS ONE Mtr. DEEP HOLE AND Dia OF 1.2 TIMES THE BOTTOM DIMENSION OF THE POLE.
		4.1.3) PLANTING DEPTH IN GROUND	C	DIMENSIONAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	1.5 m ABOVE PRE- CAST SLAB	SITE REGISTER	IN CASE OF BLACK COTTON & WET SOILS PLANTING DEPTH INCREASED BY 0.2 Mtr
4.2	BASE FOUNDATION	BASE CONCRETE	C	MEASUREMENT	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	M-15 GRADE SIZE 0.45M X 0.45M X 0.075 m	SITE REGISTER	EQUIVALENT SIZE STONE PLATE CAN ALSO BE USED WHERE EVER FOUND ECONOMICAL
4.3	POLE ERECTION	4.3.1) POLE ERECTION	C	VISUAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	"1)POLES SHALL BE LIFTED TO THE PIT WITH THE HELP OF WOODEN SUPPORTS 2)THE POLE SHALL BE KEPT IN VERTICAL POSITION WITH THE HELP 25mm MANILA ROPES."		
		4.3.2) ALIGNMENT & VERTICALITY IN BOTH DIRECTIONS	C	SPIRIT LEVEL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS		SITE REGISTER	

SL.NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		4.3.3) BACK FILLING	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	WITH BRICK BATS AND COMPACTED IN LAYERS	SITE REGISTER	TEMPORARY ANCHORS SHALL BE REMOVED ONLY AFTER THE POLE IS SET IN THE FOUNDA- TION AFTER COMPACT- ING THE SOIL.
		4.3.4) CONCRETING OF FOUNDATIONS	C	"MEA- SURE EMENT"	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS		SITE REGISTER	AT ALL TAPPING POINTS, DEAD ENDPOLES, AT DT LOCATIONS, AT ALL POINTS AS PER REC CONSTRUCTION DRAWING AT 1 km OF LAST JAMA FILLED STRUCTURE, BOTH SIDE POLES OF NALLA CROSSINGS, ROAD CROSSING, RAILWAY CROSSINGS, AT DP , 4P STRUCTURE.
		5.1) COIL TYPE EARTHING	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	REC CON- STRUCTION STANDARD J-1	SITE REGISTER	
6	COIL TYPE EARTHING INSTALLA- TION	a) EXCAVATION OF PIT SIZE (DIA- 600 X 1500 mm)	C	VISUAL/ DIMEN- SIONAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	REF: REC CONSTRUC- TION STAN- DARD -J-1	SITE REGISTER	
		b) INSTALEARTHING SPIRAL	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS			ENSURE THE SPIRAL WIRE IS 4mm GI WIRE

SL.NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer- in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RE- CORD	RE MARKS
		c) FILL THE PIT WITH ALTERNATE LAYERS OF 300mm WITH CHARCOAL AND SALT UPTO 1.2 Mtr.OF DEPTH FROM BOTTOM OF THE PIT.	B	VISUAL	100%	UTILITY / REC SPECIFICA-TION or AS PER ACCEP-TANCE NORMS			
		d) CONNECTION BETWEEN THE SPIRAL WIRE AND POLE EARTH WIRE	C	VISUAL	100%	UTILITY / REC SPECIFICA-TION or AS PER ACCEP-TANCE NORMS			
		6.1) PIPE/RODTYPE EARTHING	C	VISUAL	100%	UTILITY / REC SPECIFICA-TION or AS PER ACCEP-TANCE NORMS	REC CON-STRUCTION STANDARD J-2	SITE REGISTER	AT BOTH SIDES OF RAILWAY, ROAD, DRAIN, TELECOM, RIVER CROSSINGS
7	PIPE TYPE EARTHING INSTALLATION	a) EXCAVATION OF PIT SIZE BY 0.6M Dia X 2.7M DEPTH	C	VISUAL	100%	UTILITY / REC SPECIFICA-TION or AS PER ACCEP-TANCE NORMS	REF: REC CON-STRUCTION STANDARD- J-2	SITE REGISTER	
		b) INSTALL 40 Dia GI PIPE WITH 12 Dia HOLES IN THE PIT.	C	VISUAL	100%	UTILITY / REC SPECIFICA-TION or AS PER ACCEP-TANCE NORMS			

		c)FILL THE PIT WITH ALTERNATE LAYERS OF 300mm CHAR COAL AND SALT.	B	VISUAL	100%	UTILITY / REC SPECIFICA- TION or AS PER ACCEP- TANCE NORMS			
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SL.NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		d) CONNECTION BETWEEN THE PIPE AND POLE WITH 8mm SWG WIRE	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS			
8	STAY / GUY ERECTION	8.1) LOCATION FOR THE GUY SETS	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS			THE GUY SETS ARE ERECTED AT ANGLE LOCATIONS ,DEAD END LOCATIONS , T-Off POINTS , STEEP GRADIENT LOCATIONS, DOUBLE POLE STRUCTURES.
		8.2) EXCAVATION OF PIT SIZE 0.5MX0.5M X 1.6M	C	DIMENSIONAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	REC CONSTRUCTION STANDARD G-1		
		8.3)SIZING OF ANCHOR PLATE	C	DIMENSIONAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	REC CONSTRUCTION STANDARD K-1		
		8.4)GROUTING OF ANCHOR PLATE AND ANCHOR ROD WITH EARTH FILLING	C	DIMENSIONAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS			IF GUY WIRE IS FOUND HAZARDOUS IT SHOULD BE PROTECTED WITH ASBESTOS PIPE FILL WITH CONCRETE
		8.5)ANGLE BETWEEN STAY WIRE AND POLE	B	"MEASUREMENT"	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	REC CONSTRUCTION STANDARD G-1		

SL.NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer- in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		8.6)ERECTION OF GUY INSULATOR	C	VISUAL	100%	UTILITY REC SPECIFICA- TION or AS PER ACCEP- TANCE NORMS	REC CON- STRUCTION STANDARD G-1		GUY INSULATORS ARE ERECTED AT HEIGHT OF 3050 mm FROMTHE GROUND.
		8.7) ERECTION TURNBUCKLE	C	VISUAL	100%	UTILITY REC SPECIFICA- TION or AS PER ACCEP- TANCE NORMS	REC CON- STRUCTION STANDARD G-1		TURN BUCKLE ARE MOUNTED HALF WAY INTHEWORKING PO- SITION , THUS GIVING THE Max. MOVEMENT FOR TIGHTENING AND LOOSENING
CLASS OF CHECK: A -- CRITICAL B -- MAJOR C-- MINOR NAME/ SIGNATURE OF THE -CONTRACTOR/ ERECTION AGENCY									

FIELD QUALITY PLAN--ERECTION OF 11KV POLE ACCESSORIES									
Item: ERECTION OF 11KV POLE ACCESSORIES									
Sub-system: G.I COMPONENTS, INSULATORS, HARDWARE FIT- TINGS, DANGER BOARDS, ANTI-CLIMBING DEVICES, GUARDING									
MS GALVANIZED COMPONENTS									
SL.NO	MAIN ACTIV- ITY& OPERA- TION	CHARAC- TERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer- in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
1	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL CHECK	100%		CORRELATION OF THE LOT RECEIVED WITH TC	STORES REG- ISTER	COMPONENTS WHICH ARE INSPECTED AND CLEARED BY PIA SHALL ONLY BE AC- CEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL CHECK	100%		DAMAGED AND GALVANIZATION DEFECTIVE COMPONENTS ARE TO BE STACKED SEPA- RATELY	STORES REG- ISTER	
		3) PROPER STORAGE	0	VISUAL CHECK	100%	UTILITY / REC SPECIFICA- TION or AS PER ACCEPTANCE NORMS	ALL G.I. COMPO- NENTS SHOULD BE STACKED ON WOODEN SLEEPERS AND THE STORAGE AREA SHALL BE FREE FROM WA- TER LOGGING	STORES REG- ISTER	

SL.NO	MAIN ACTIV- ITY& OPERA- TION	CHARAC- TERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer- in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
2	FIXING OF MS COMPONENTS	1) V- CROSS ARM WITH CROSS ARM BACK CLAMP	C	VISUAL CHECK	100%	UTILITY / REC SPECIFICA- TION or AS PER ACCEPTANCE NORMS	AS PER AP- PROVED DRAW- ING	SITE REGIS- TER	CROSS ARMS ARE TO BE FIXED AT THE MARKINGS PROVIDED ON THE POLES
		2) HORIZON- TAL ALIGN- MENT OF CROSS ARMS WITH POLE	C	WATER LEVEL	100%	APPROVED DRAWING	APPROVED DRAWING		
		3) TOP CLEAT WITH BACK CLAMP	C	VISUAL CHECK	100%	UTILITY / REC SPECIFICA- TION or AS PER ACCEPTANCE NORMS	AS PER AP- PROVED DRAW- ING	SITE REGIS- TER	TOP CLEATS ARE TO BE FIXED AT THE MARKINGS PROVIDED ON THE TOP OIF THE POLE
		4) VERTICAL ALIGNMENT OF TOP CLEAT WITH POLE	C	WATER LEVEL	100%	APPROVED DRAWING	APPROVED DRAWING		
		5) TIGHT- ENING MS COMPONENTS WITH NUTS, BOLTS AND WASHERS	C	ERECTION CHECK	100%	APPROVED DRAWING	THE COMPO- NENTS SHOULD BE FIXED RIGID ENOUGH TO WITH STAND ALL THE FORCES	SITE REGIS- TER	

INSULATORS WITH PINS									
3	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL CHECK	100%	UTILITY / REC SPECIFICA- TION or AS PER ACCEPTANCE NORMS	CORRELATION OF THE LOT RECEIVED WITH THE CHP DE- SCRIPTIONS	SITE REGIS- TER	COMPONENTS WHICH ARE INSPECTED AND CLEARED BY PIA SHALL ONLY BE ACCEPTED ON RECEIPT

L.NO	MAIN ACTIV-ITY & OPERA-TION	CHARACTERIS-TICS/ INSTRU-MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK -Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		2) VISUAL INSPECTION	C	VISUAL CHECK	100%		THE SURFACE OF THE INSULATORS ARE TO BE THOROUGH- LY CHECKED AND CLEANED THREADING OF THE INSULATOR THIMBLE TO BE CHECKED	STORES REG- ISTER	DAMAGED IN- SULAOTRS ARE TO BE STACKED SEPARATELY
		3) PROPER STORAGE	C	VISUAL CHECK	100%	STANDARD PRACTICE		STORES REG- ISTER	
4	FIXING INSULATORS OF	1) CHECK THREADING OVER THE PINS AND INSULA- TOR THIMBLES AND CHECK THE ALIGN- MENT OF PIN WITH INSULA- TOR	C	VISUAL CHECK	100%	UTILITY / REC SPECIFICA- TION or AS ACCEPTANCE NORMS	AS PER AP- PROVED DRAW- ING	SITE REGIS- TER	AT GROUND LEVEL THIS PREASSEMBLY CHECK IS DONE FOR PROPER AS- SEMBLY
		2) ASSEMBLING THE GI PIN AND INSULATORS	C	VISUAL	100%	APPROVED DRAWING	APPROVED DRAWING		
		3) FIXING THE PIN INSULA- TOR TO THE CROSSARMS AND POLE TOP BRACKET	C	VISUAL CHECK	100%	UTILITY / REC SPECIFICA- TION or AS ACCEPTANCE NORMS	AS PER AP- PROVED DRAW- ING	SITE REGIS- TER	ON ALL THE POLES IN THE STRAIGHT LINE PIN INSULATORS SHALL BE USED. DISC INSULATORS ARE USED AT DEAD END AND ANGLE LOCA- TIONS

S.NO.	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		4) CHECK THE CLEARANCES BETWEEN THE INSULATORS	B	DIMENSIONAL	RANDOM	UTILITY / REG SPECIFICATION or AS PER ACCEPTANCE NORMS	APPROVED DRAWING		FOR CHECKING THE CLEARANCES SUITABLE TEMPLATE/ JIGS ARE TO BE USED
CLASS OF CHECK: A -- CRITICAL B -- MAJOR C-- MINOR									
NAME/SIGNATURE OF THE CONTRACTOR/ERECTION AGENCY									

FIELD QUALITY PLAN FOR ISOLATOR, AB								
ITEM: ERECTION WORK								
SUB SYSTEM: ISO/ AB SWITCH/ DOFUSE SWITCH/ DO FUSE								
Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
1	RECEIPT & STORAGE							
1.1	Receiving inspection (Completeness of documents, test certificates, instruction manual etc.)	V	-	B	100%	Delivery Challan	MRC	
1.2	Unloading	V	-	B	100%	Instruction Manual	-	
1.3	Visual examination for damage & defects	V	-	B	100%	Packing list / Instruction Manual	-	
1.4	Proper storage	V	-	B	100%	Instruction Manual	-	
2	PRE INSTALLATION							
2.1	Availability of instruction manual and drawing, lifting arrangement	V	-	B	100%	List of approved drawing / Instruction Manuals	-	
2.2	Availability of all materials	V	-	B	100%	Packing list, Approved drawing & Bill Of Material	-	
2.3	Foundation (If required)	V	-	B	100%	Civil foundation drawing	-	
2.4	Verticality of support structure	V	-	B	100%	GA/ Structural drawing	-	
3	INSTALLATION							
3.1	Rating plate details	V	-	B	100%	instruction manual	Site record	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
3.2	Check for proper slinging & lifting	V	-	B	100%	Instruction Manual	-	
3.3	Check for the tightness of base bolts & other bolted joints preferably by torque wrench.	V	-	B	100%	Instruction Manual	-	
3.4	Check level & alignment of the base, housing assembly and flanges.	V	-	B	100%	Instruction Manual	-	
3.5	Ensure proper erection of poles, main blade & drive assembly as per approved drgs.	V	-	B	100%	Instruction Manual	Site record	
3.6	Check for the alignment of isolator and verticality of isolator / AB switch / DO Fuse.	V	-	B	100%	Instruction Manual	Site record	
3.7	Check for the clearance between live part to earth.	V	-	B	100%	As per IS 10118	-	
3.8	Check for no vibration or rotation of contacts of insulators during isolator operation. (Electrical & Mechanical)	V	-	B	100%	Instruction Manual	-	
3.9	Check for the provision of earthing and earth connection.	V	-	B	100%	Instruction Manual	-	
3.10	Check operation of the isolator by rotating one of the insulator stack manually and adjust the length of the crossed tandem assembly to ensure proper engagement of contacts during closing.	V	-	B	100%	Instruction Manual	-	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
4	PRE COMMOSSIONING							
4.1	Check for visual damage to any parts including porcelain isolator.	V	-	B	100%	Instruction Manual	TC	
4.2	Check manual / operation and inter locks.	V	-	B	100%	Instruction Manual	TC	
4.3	IR Value	Test	Megger	B	100%	Instruction Manual	TC	
	a. Between each pole to earth.							
4.4	Ground connections	V	-	B	100%	Instruction Manual	TC	
4.5	Check continuity	Electrical	Multimeter	B	100%	Instruction Manual	Site Record	
CONTRACTOR'S SIGNATURE						NAME & SIGN OF APPROVING AUTHORITY		
<p>Legends :</p> <p>CLASS OF CHECK:</p> <p>A -- CRITICAL B -- MAJOR C-- MINOR</p> <p>TC: Test Certificate</p> <p>MRC : Material Receipt Certificate</p> <p>V : Visual</p> <p style="text-align: center;">EIC : Engineer In Charge</p>								

FIELD QUALITY PLAN FOR LA						ITEM : ERECTION WORK		
SUB SYSTEM : Lightening Arrestor								
Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
1	2	3	4	5	6	7	8	9
1	RECEIPT & STORAGE							
1.1	Receiving inspection (Completeness of documents, test certificates, instruction manual etc.)	V	-	B	100%	Delivery Challan	MRC	
1.2	Unloading	V	-	B	100%	Instruction Manual	-	
1.3	Visual examination for damage & defects	V	-	B	100%	Packing list / Instruction Manual	-	
1.4	Proper storage	V	-	B	100%	Instruction Manual	-	
2	PRE INSTALLATION							
2.1	Availability of instruction manual and drawing, lifting arrangement	V	-	B	100%	List of approved drawing / Instruction Manuals	-	
2.2	Availability of all materials	V	-	B	100%	Packing list, Approved drawing & Bill Of Material	-	
2.3	Verticality of support structure	V	-	B	100%	GA/ Structural drawing	-	
3	INSTALLATION							
3.1	Rating plate details	V	-	B	100%	instruction manual	Site record	
3.2	Check cleanliness of surfaces of the arrester and check Megger value.	Test	Megger	B	100%	Instruction manual	-	
3.3	Check base of the surge arrester.	V	-	B	100%	Instruction manual	-	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
3.4	Check the tightness of equipment base with structure.	V	-	B	100%	Instruction manual	-	
3.5	Ensure that the explosion vent of the LA is away from adjacent critical equipment.	V	-	B	100%	Instruction manual	-	
3.6	Check earthing provision and connection tightness.	V	-	B	100%	Instruction manual	-	
3.7	Check clearance between live part to earth part.	V	-	B	100%	Instruction manual	-	
3.8	Check overall alignment of LA.	V	-	B	100%	Instruction manual	-	
3.9	Mounting height of LA	Measure	-	B	100%	Instruction manual	Site record	
4	PRE COMMISSIONING							
4.1	IR Value test	Test	Megger	A	100%	Instruction manual	TC	
4.2	Check for resistance of ground connection.	Test	-	B	100%	Instruction manual	TC	
4.3	Earth continuity test	Test	Earth Megger	B	100%	Instruction manual	TC	
4.4	Final Document review	V	-	B	100%	instruction manual / final document list	TC	
CONTRACTOR'S SIGNATURE					NAME & SIGN OF APPROVING AUTHORITY			

FIELD QUALITY PLAN FOR PAINTING								
ITEM : ERECTION WORK								
SUB SYSTEM: PAINTING								
Sr. No.	CHARACTERIS- TICES / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in- Charge	Reference Docu- ments & Accep- tance Standard	“Format Of Records”	Remarks
1	2	3	4	5		7	8	9
1	RECEIPT & STOR- AGE							
1.1	Recveiving inspection	V		C	100%	Delivery Challan & Specification	MRC	
1.2	Proper storage	V		C	100%	5%	Site Records	
2	PAINTING							
2.1	De rusting from struc- tutres & other rusted part of the equipment	V	Wire Brush, emery paper	B	100%	As per EIC	-	
2.2	Red oxide zinc chromate paint on steel structures - Two Coats	V	Paint brush	B	100%	As per EIC / IS 2074	Site Records	
2.3	Synthetic enamel paint - Two Coats or more coats	V	Paint brush	B	100%	As per EIC / IS 2932	Site Records	
2.4	Aluminium Paint - Two Coats or more coats	V	Paint brush	B	100%	As per EIC / IS 2339	Site Records	
2.5	Final document review	-	-	B	100%	Final document list	Site Records	
CONTRACTOR'S SIGNATURE					NAME & SIGN OF APPROVING AUTHORITY			

FIELD QUALITY PLAN									
Item: ERECTION OF BPL CONNECTION									
Sub-system:									
SL. NO	MAIN ACTIVITY& OPERATION	CHARACTERIS - TICS / INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
SECTION 1 : BOUGHT OUT ITEMS OF BPL CONNECTION									
1	RECEIPT AND STOR- AGE	1) RECEIPT AT STORES	C	VISUAL CHECK	100%	APPROVED BOM AND APPROVED DRAWING	APPROVED MAKE OF THE ITEM	STORES REGISTER	
		2) VISUAL IN- SPECTION	C	VISUAL CHECK	100%		DAMAGED AND DE- FECTIVE COMPO- NENTS ARE TO BE REPLACED WITH GOOD ONE	STORES REGISTER	THE METER BOARD SHALL BE OF TEAK WOOD QUALITY OR HARD WOOD
		3) PROPER STORAGE	C	VISUAL CHECK	100%	STANDARD PRACTICE	STANDARD PRAC- TICE	STORES REGISTER	
SECTION : 2 FIXING OF BOARDS AND ACCESSORIES									
2	FIXING OF BOARDS AND AC- CESSORIES	1) IDENTIFYING AND MARKING THE POSITIONS WHERE THE COMPONENTS ARE TO BE ERECTED	C	VISUAL CHECK	100%	AS PER SPECIFICA- TION	AS PER APPROVED DRAWING	SITE REGIS- TER	CLEARANCE SHALL BE MAINTAINED AS PER APPROVED DRAWING AND AS PER SPECIFI- CATION
		2) FIXING THE SERVICE SUP- PORTS AND GUYS	C	VISUAL CHECK	100%	AS PER SPECIFICA- TION	AS PER APPROVED DRAWING	SITE REGIS- TER	THE SURFACE OF ALL SUP- PORTS SHOULD BE CLEANED.

S.NO	MAIN ACTIVITY& OPERATION	CHARACTERIS- TICS / INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		"3) FIXING OF THE WOODEN BOARDS (METER BOARD AND SWITCH BOARD)"	C	DIMEN- SIONAL	100%	AS PER SPECIFICA- TION	AS PER APPROVED DRAWING	SITE REGIS- TER	
		4) FIXING OF ALL OTHER ACCES- ORIES	C	VISUAL CHECK	100%	AS PER SPECIFICA- TION	AS PER APPROVED DRAWING	SITE REGIS- TER	
SECTION : 3 STRINGING OF SERVICE CABLE									
3	STRINGING OF SERVICE CABLE	1) HANDLING OF THE CABLE	C	VISUAL CHECK	100%	AS PER SPECIFICA- TION	CABLE SHOULD NOT BE DRAGGED ON THE GROUND	SITE REGIS- TER	CABLE SURFACE SHALL BE FREE FROM FAULTS, FLAWS e.t.c
		2) SEQUENCE OF CABLE EREC- TION	C	VISUAL CHECK	100%	AS PER SPECIFICA- TION	SEQUENCE OF RUNNING OUT SHALL BE FROM TOP TO BOTTOM, i.e.. THE TOP CABLE SHALL RUN OUT FIRST, FOLLOWED BY THE SIDE CABLES	SITE REGIS- TER	
		3) FIX THE G.I WIRE OF SER- VICE CABLE TO CLAMPS	C	VISUAL CHECK	100%	AS PER SPECIFICA- TION	SPECIFICATION / AS PER APPROVED DRAWING	SITE REGIS- TER	
		4) CHECK THE TIGHTNESS OF SERVICE CABLE WITH CLAMPS	C	VISUAL CHECK	100%	AS PER SPECIFICA- TION	AS PER THE STAN- DARD PRACTICE	SITE REGIS- TER	

S.NO	MAIN ACTIVITY& OPERATION	CHARACTERIS- TICS / INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		5) CHECK THE GROUND CLEARANCES AFTER EREC- TION OF THE SERVICE CABLE	C	VISUAL CHECK	100%	AS PER THE REC SPECIFI- CATIONS	AS PER IE RULES	SITE REGIS- TER	THE MINIMUM GROUND CLEAR- ANCES SHOULD BE MAINTAINED
SECTION : 4 EARTHING ARRANGEMENT									
4	EARTHING ARRANGE- MENT	1) LOCAL EARTHING OF BPL HOUSE HOLD	C	VISUAL CHECK	100%	STANDARD PRACTICE / IS 3043	IS 3043	SITE REGIS- TER	
		2) EARTHING OF GI SUPPORT WIRE	C	VISUAL CHECK	100%	STANDARD PRACTICE / IS 3043	IS 3043	SITE REGIS- TER	
SECTION : 5 CHARGING OF BPL CONNECTION									
4	CHARGING OF BPL CONNEC- TION	1) CHECK THE CONTINUITY OF CONNECTION	C	TEST	100%	STANDARD PRACTICE	STANDARD PRAC- TICE	SITE REGIS- TER	
		2) CONNECTION OF SERVICE LINE TO THE POLE	C	VISUAL CHECK	100%	STANDARD PRACTICE	STANDARD PRAC- TICE	SITE REGIS- TER	TAKE LINE CLEAR ON POLE FROM WHICH SERVICE LINE TO BE TAPPED
		3) CHARGING OF SERVICE CON- NECTION	C	VISUAL CHECK	100%	STANDARD PRACTICE	STANDARD PRAC- TICE	SITE REGIS- TER	CHECK FOR ANY ABNORMALITIES AT THE BOARD

FIELD QUALITY PLAN FOR VCB								
Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
1	2	3	4	5	6	7	8	9
1	RECEIPT & STORAGE							
1.1	Receiving inspection (Completeness of documents, test certificates, instruction manual etc.)	V	-	B	100%	Delivery Challan	MRC	
1.2	Unloading	V	-	B	100%	Instruction Manual	-	
1.3	Visual examination for damage and defects	V	-	B	100%	Packing list / Instruction Manual	-	
1.4	Proper storage	V	-	B	100%	Instruction Manual	-	
2	PRE INSTALLATION							
2.1	Availability of instruction manual and drawing, lifting arrangement	V	-	B	100%	List of Approved drawing/ Instruction Manual	-	
2.2	Availability of all materials	V	-	B	100%	Packing list ,Approved drawing & Bill of Material	-	
2.3	VCB foundation	V	-	B	100%	Civil foundation drawing	-	
2.4	VCB Support structure (Level & Verticality)	V	-	B	100%	GA/ Structural drawing	-	
3	INSTALLATION							
3.1	Before erection check adequacy of lifting device.	V	-	B	100%	instruction manual	-	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
3.2	Ensure that breaker are erected with proper handling equipment, check slings, dereck/tripod & rope .	V	-	B	100%	instruction manual	-	
3.3	Ensure erection has been done as per approved drawing and manual.	V	-	B	100%	GA/equipment detail drawing	-	
3.4	Check for Individual pole and CB alignment.	V	-	B	100%	instruction manual	-	
3.5	Check for the tightness of pole base bolt with structure.	V	-	B	100%	instruction manual	-	
3.6	Check for the checknut tightness of tie rod. (if applicable)	V	-	B	100%	instruction manual	-	
3.7	Check for cable termination, ferrules and cable tags are provided (with proper lugs and glands)	V	-	B	100%	instruction manual	-	
3.8	Lubricate all the moving parts of the CB.	V	-	B	100%	instruction manual	-	
3.9	Earthing of support structure & VCB frame.	V	-	B	100%	instruction manual	-	
4	PRE-COMMISSIONING							
4.1	Check correct installation of circuit breaker & operating mechanism as per instruction manual.	V	-	B	100%	instruction manual	-	
4.2	Insulation resistance of each pole	Test	Megger	A	100%	instruction manual	TC	
4.3	Insulation resistance of control circuits, motor etc.	Test	Megger	A	100%	instruction manual	TC	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
4.4	Resistance of closing & tripping coils.	Test	Multimeter	A	100%	instruction manual	TC	
4.5	Minimum pick up volts of coils	Test	Multimeter	A	100%	instruction manual	TC	
4.6	Contact resistance	Test	Multimeter	A	100%	instruction manual	TC	
4.7	Breaker closing & tripping time	V	-	A	100%	instruction manual	TC	
4.8	Functional checking of all accessories.	Test	Multimeter	B	100%	instruction manual	TC	
4.9	Functional checking of control circuits, tripping through protective relays and auto reclose operation.	Test	Multimeter	B	100%	instruction manual	TC	
4.10	Final document review	V	-	B	100%	instruction manual/final document list	TC	
CONTRACTOR'S SIGNATURE							NAME & SIGN OF APPROVING AUTHORITY	
Legends : CLASS OF CHECK: A -- CRITICAL B -- MAJOR C-- MINOR TC : Test Certificate MRC : Material Receipt Certificate V : Visual EIC : Engineer In Charge								

FIELD QUALITY PLAN									
Item: DTR STRUCTURE AND COMPONENTS									
Sub-system: ERECTION TRANSFORMER STRUCTURE									
SECTION - I : MS GALVANIZED COMPONENTS									
S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
1	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHALLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHALLAN / MDCC DESCRIPTIONS	SITE REGISTER	COMPONENTS WHICH ARE INSPECTED AND CLEARED SHALL ONLY BE ACCEPTED
		2) VISUAL INSPECTION	C	VISUAL	100%		DAMAGED AND GALVANISATION DEFECTIVE COMPONENTS ARE TO BE STACKED SEPARATELY	STORES REGISTER	
		3) PROPER STORAGE	C	VISUAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	ALL G.I. COMPONENTS SHOULD BE STACKED ON WOODEN SLEEPERS AND THE STORAGE AREA SHALL BE FREE FROM WATER LOGGING	STORES REGISTER	
2	FIXING OF MS COMPONENTS	1) CHECK THE ALIGNMENT OF TWO POLES	C	VISUAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	BOTH THE POLES SHOULD BE PARALLEL TO EACH OTHER AND SHOULD BE PLANTED AT SAME DEPTH
		2) FIX THE TOP CHANNEL	C	VISUAL	100%	UTILITY / REGISTRATION or AS PER ACCEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	CHECK THE ALIGNMENT OF THE TOP CHANNEL WITH THE POLE

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		3) FIX THE FISH PLATE	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	THESE FISH PLATE SHOULD BE PLACED RIGIDLY AND HOLES ARE TO BE CHECKED
		3) FIX THE BELTING ANGLES WITH BELTING ANGLE BACK CLAMP	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	ANGLES SHOULD BE FIXED FROM SPECIFIED FROM GROUND
		4) HORIZONTAL ALIGNMENT OF THE BELTING ANGLE WITH POLES	C	DIMENSIONAL	100%	APPROVED DRAWING	APPROVED DRAWING	SITE REGISTER	
		5) FIX THE BRACING ANGLES WITH BRACING ANGLE CLAMP	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	THE BOLTS AND NUTS SHALL BE TIGHT ENOUGH TO HOLD THE BRACING TO THE POLE
		6) ALIGNMENT OF THE BRACING ANGLE WITH BELTING ANGLES	C	DIMENSIONAL	100%	APPROVED DRAWING	APPROVED DRAWING	SITE REGISTER	THE ANGLE BETWEEN THE TWO BRACING SHOULD BE 90° AND SHOULD BE RIGID ENOUGH TO BEAR THE FORCES

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
3	STAY GUY ERECTION	8.1) LOCATION FOR THE GUY SETS	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS		SITE REGISTER	AS PER APPROVED DRAWING THE NUMBER OF STAYS ARE TO BE ERECTED
		8.2) EXCAVATION OF PIT SIZE 0.5M X 0.5M X 1.6M	C	DIMENSIONAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	REC CONSTRUCTION STANDARD G-1	SITE REGISTER	
		8.3) SIZING OF ANCHOR PLATE	C	DIMENSIONAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	REC CONSTRUCTION STANDARD K-1	SITE REGISTER	
		8.4) GROUTING OF ANCHOR PLATE AND ANCHOR ROD WITH EARTH	C	DIMENSIONAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS		SITE REGISTER	IF GUY WIRE IS FOUND HAZARDOUS IT SHOULD BE PROTECTED WITH ASBESTOS PIPE FILL WITH CONCRETE

		FILL- ING						
		8.5)ANGL E BETWEE N STAY WIRE AND POLE	B	"MEA- SURE EMENT "	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	REC CONSTRUCTION STANDARD G-1	SITE REGISTER

S. NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		8.7) ERECTION TURN-BUCKLE	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	REC CONSTRUCTION STANDARD G-1	SITE REGISTER	TURN BUCKLE ARE MOUNTED HALF WAY IN THE WORKING POSITION , THUS GIVING THE Max. MOVEMENT FOR TIGHTENING AND LOOSENING
		8.8) ENSURE THE RIGIDNESS OF THE STRUCTURE	C	VISUAL	100%	STANDARD PRACTICE	APPROVED DRAWING	SITE REGISTER	
SECTION - II : FIXING OF INSULATORS									
4	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHALLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHALLAN / MDCC DESCRIPTIONS	SITE REGISTER	COMPONENTS WHICH ARE INSPECTED AND CLEARED BY PIA SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%		THE SURFACE OF THE INSULATOR IS TO BE THOROUGHLY CHECKED AND CLEANED, THE THREADING OF THE INSULATOR IS TO BE CHECKED	STORES REGISTER	DAMAGED INSULATORS ARE TO BE STACKED SEPARATELY
		3) PROPER STORAGE	C	VISUAL	100%	STANDARD PRACTICE		STORES REGISTER	

S. NO	MAIN ACTIVITY& OPERATION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFER- ENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
5	FIXING OF INSULATORS	1) CHECK THREADING OVER THE PINS AND INSULA- TORS AND CHECK THE ALIGNMENT OF PIN WITH INSU- LATOR	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	
		2) ASSEM- BLING THE GI PIN AND INSULA- TORS	C	VISUAL	100%	APPROVED DRAWING	APPROVED DRAWING		
		3) FIX THE PIN INSULA- TOR OVER THE FISH PLATES	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	PIN INSULATORS SHALL BE TIGHTENED RIGIDLY TO WITH STAND THE LOAD.
		4) CHECK THE CLEAR- ANCES BETWEEN THE INSU- LATORS	B	DIMEN- SIONAL	RANDOM	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	APPROVED DRAWING		FOR CHECKING THE CLEARANCES SUITABLE TEMPLATE/ JIGS ARE TO BE USED
		5) NOW FIX THE RE- SPECTIVE DISC IN- SULATORS WITH DISC INSULATOR CLAMPS	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	AS PER APPROVED DRAWING	SITE REGISTER	DEPENDING ON TYPE OF LOCATION T&C OR B&S ARE TO BE USED AS PER APPROVED DRAWING

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		6) CHECK THE CLEARANCES BETWEEN THE INSULATORS	B	DIMENSIONAL	RANDOM	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	APPROVED DRAWING		FOR CHECKING THE CLEARANCES SUIT- ABLE TEMPLATE/ JIGS ARE TO BE USED
SECTION - III : FIXING OF 11KV HG FUSE									
6	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHALLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHALLAN	STORES REGISTER	COMPONENTS WHICH ARE INSPECTED AND CLEARED SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%		DAMAGED AND DEFECTIVE EQUIPMENT SHALL BE STACKED SEPARATELY	STORES REGISTER	MAJOR DAMAGED MATERIAL SHALL BE DISCARDED.
		3) PROPER STORAGE	C	VISUAL	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS	THE HG FUSE COMPONENTS SHALL BE STORED ON WOODEN PLATFORM OF 300mm DEPTH	STORES REGISTER	
7	FIXING OF HG FUSE SET	1) RATING PLATE DETAILS	C	VISUAL	100%	STANDARD PRACTICE	APPROVED DRAWINGS	STORES REGISTER	
		2) CHECK LEVEL & ALIGNMENT OF THE BASE, HOUSING ASSEMBLY & FLANGS	C	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL	SITE REGISTER	
		3) CHECK FOR THE CLEARANCE BETWEEN LIVE PART TO EARTH	B	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
SECTION - IV : ERECTION AND COMMISSIONING OF LINE SECTIONALIZER / AB SWITCH									
8	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHALLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHAL- LAN	STORES REGIS- TER	COMPONENTS WHICH ARE INSPECTED AND CLEARED SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%		DAMAGED AND DEFEC- TIVE EQUIPMENT SHALL BE STACKED SEPARATELY	STORES REGIS- TER	MAJOR DAMAGED MATERIAL SHALL BE DISCARDED.
		3) PROPER STORAGE	C	VISUAL	100%	STANDARD PRACTICE	THE AB SWITCH COM- PONENTS SHALL BE STORED ON WOODEN PLATFORM OF 300mm DEPTH	STORES REGIS- TER	
9	FIXING OF LINE SECTION- ALIZER/ AB SWITCH	A) INSTAL- LATION							
		1) RAT- ING PLATE DETAILS	C	VISUAL	100%	STANDARD PRACTICE	APPROVED DRAWING	SITE REGISTER	
		2) CHECK FOR PROPER SLING AND LIFTING	C	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL	SITE REGISTER	
		3) CHECK TIGHTNESS OF BASE BOLTS AND OTHER BOLTED JOINTS BY TORQUE WRENCH	C	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL	SITE REGISTER	

S. NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		4) CHECK LEVEL & ALIGNMENT OF THE BASE, HOUSING ASSEMBLY & FLANGES	C	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL	SITE REGISTER	
		5) ENSURE PROPER ERECTION OF POLES, MAIN BLADE & DRIVE ASSEMBLY AS PER APPROVED DRAWINGS	C	VISUAL	100%	STANDARD PRACTICE	APPROVED DRAWING	SITE REGISTER	
		6) CHECK FOR THE ALIGNMENT AND VERTICALITY OF SECTIONALIZER	C	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	
		7) CHECK FOR THE CLEARANCE BETWEEN LIVE PART TO EARTH	B	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	

S. NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS/INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		9) CHECK FOR NO VIBRATION OR ROTATION OF CONTACTS INSULATORS DURING ISOLATOR OPERATION	C	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL	SITE REGISTER	
		10) CHECK FOR THE PROVISION OF EARTHING AND EARTH CONNECTION	C	VISUAL	100%	STANDARD PRACTICE	APPROVED DRAWING	SITE REGISTER	
		11) CHECK OPERATION OF THE ISOLATOR BY ROTATING ONE OF THE INSULATOR STACK MANUALLY AND ADJUST THE LENGTH OF THE CROSSED TANDEM ASSEMBLY TO ENSURE PROPER ENGAGEMENT OF CONTACTS DURING CLOSING.	B	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	ENSURE THE ENTIRE STRUCTURE SHOULD BE RIGID AND CHECK THE RIGIDNESS BY OPERATING THE AB SWITCHES

S. NO	MAIN ACTIVITY& OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
10	PRE COM-MISSION- ING	1) CHECK FOR VISUAL DAMAGE TO ANY PARTS INCLUDING PORCELAIN ISOLATOR	C	VISUAL	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	
		2) CHECK MANUAL / OPERATION AND INTER LOCKS	B	VISUAL CHECK	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	
		3) IR VALUE BETWEEN EARTH TO POLE	B	VISUAL CHECK	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	
		4) GROUND CONNECTIONS	C	VISUAL CHECK	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	
		5) CHECK CONTINUITY	B	VISUAL CHECK	100%	STANDARD PRACTICE	INSTRUCTION MANUAL / APPROVED DRAWING\	SITE REGISTER	
SECTION - V : ERECTION & COMMISSIONING OF DTRS									
11	RECEIPT AND STORAGE	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHALLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHALLAN / MDCC DESCRIPTIONS	STORES REGISTER	TRANSFORMERS AND ACCESSORIES INCLUDING LAs WHICH ARE INSPECTED AND CLEARED SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%	APPROVED DRAWING	DAMAGED COMPONENTS SHALL BE STAGED SEPARATELY	STORES REGISTER	MAJOR DAMAGED MATERIAL SHALL BE DISCARDED.

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERIS- TICS/INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFER- ENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RE- CORD	REMARKS
		3) PROPER STOR- AGE	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	THE TRANSFORMERS AND THE ACCES- ORIES SHALL BE STACKED ON DRY LEVELLED AND RAISED PLATFORM. ALL PIPE WORK CONSERVA- TORS, RADIATORS SHOULD BE STORED WITH THEIR BLANKING PLATES IN POSITION HEATERS IN THE MARSELLING BOX SHOULD BE KEPT ENERZIZED TO AVOID CONDENSATION	STORES REGISTER	
12	ERECTI ON OF TRANS- FORME RS	1) ENSURE THE REGIDNESS OF THE STRUCTURE OVER WHICH TRANFORMER IS TO BE ERECTED	C	VISUAL	100%	STANDAR D PRACTICE	AS PER APPROVED DRAWING	SITE REGISTER	

		2) LIFTING OF THE TRANSFORMERS	C	VISUAL	100%	AS PER MANUFACTURER INSTRUCTION MANUAL	"VERTICALITY OF THE TRANSFORMERS SHALL BE MAINTAINED HV / LV ORIENTATION OF THE TRANSFORMER SHALL BE CHECKED"	SITE REGISTER	
		3) ENSURE PROPER SITTING OF THE TRANSFORMER OVER THE STRUCTURE	C	VISUAL	100%	STANDARD PRACTICE	THERE SHOULD NOT BE ANY MOVEMENT OF THE TRANSFORMER AND TRANSFORMER SHALL BE FIXED RIGIDLY TO THE STRUCTURE	SITE REGISTER	THE BOLTS AND NUTS SHALL BE TIGHT ENOUGH TO HOLD THE TRANSFORMER WITHOUT ANY SHAKE

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		4) HV / LV POSITION	C	VISUAL	100%	AS PER MANUFACTURER INSTRUCTION MANUAL	AS PER APPROVED DRAWING	SITE REGISTER	AIR CLEARANCE SHOULD BE AS PER APPROVED DRAWING
		5) OTHER ACCESSORIES LIKE LAs, BUSHINGS, CONNECTORS ETC. ARE ERECTED	C	VISUAL	100%	AS PER MANUFACTURER INSTRUCTION MANUAL	AS PER APPROVED DRAWING	SITE REGISTER	AIR CLEARANCES SHOULD BE AS PER APPROVED DRAWING
13	PRE COMMISSIONING CHECKS	1) INSULATION RESISTANCE	A	TEST	100%	UTILITY / REC SPECIFICATION or AS PER ACCEPTANCE NORMS		SITE REGISTER	A 5 KV MEGGER PREFERABLY MOTOR OPERATED SHOULD BE USED FOR MEASURING HIGHER VALUES. BUSHINGS ARE THOROUGHLY CLEANED BEFORE TAKING IR VALUES. IR VALUES BETWEEN WINDINGS AND BETWEEN WINDINGS TO EARTH ARE CHECKED. WHILE CHECKING THESE VALUES, NO EXTERNAL LINES or LIGHTNING ARRESTERS SHOULD BE IN CIRCUIT.
		2) OIL DIELECTRIC STRENGTH TEST	A	TEST	100%	AS PER INSTRUCTION MANUAL	IS : 335 SAMPLES FROM TOP AND BOTTOM OF TRANSFORMER ARE TESTED, IF REQUIRED	SITE REGISTER	

S. No.	MAIN ACTIVITY& OPERA- TION	CHARAC- TERISTICS/ INSTRU- MENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in- Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		3) GENERALCHECKS							
		a) ALL OIL VALVES ARE IN CORRECT POSITION, CLOSED OR OPENED AS REQUIRED	C	VISUAL	100%	AS PER IN- STRUCTION MANUAL		SITE REGISTER	
		b) ALL AIR POCK- ETS ARE CLEARED	C	TEST	100%	AS PER IN- STRUCTION MANUAL		SITE REGISTER	
		c) THER-MOMETER POCKETS ARE FILLED WITH OIL	C	TEST	100%	AS PER IN- STRUCTION MANUAL		SITE REGISTER	
		d) OIL IS AT CORRECT LEVEL IN THE TRAN- FORMERS	B	TEST	100%	AS PER IN- STRUCTION MANUAL		SITE REGISTER	
		e) EARTH-ING CON- NECTIONS ARE DONE	C	TEST	100%	AS PER IN- STRUCTION MANUAL		SITE REGISTER	
		f) ARCING HORN GAPS ON BUSH-INGS ARE PROPERLY ADJUSTED	C	TEST	100%	AS PER IN- STRUCTION MANUAL		SITE REGISTER	

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
14	ENERGIZATION	CHARGING THE TRANSFORMER	A	VISUAL	100%	AS PER INSTRUCTION MANUAL	NO ABNORMILTY SUCH AS VIBRATION OF THE PARTS, HUM NOISE SHOULD BE ABSORBED	SITE REGISTER	ABNORMILITIES IF NOTICED SHOULD BE CORRECTED AFTER FEW HOURS OF ENERGISATION AT NO LOAD.
SECTION - VI : EARTHING OF DTR STATION									
15	IDENTIFICATION OF THE EARTH PITS AND EARTHING EQUIPMENT	1) IDENTIFY THE LOCATION WHERE THE EARTHING IS TO BE DONE	A	VISUAL	100%	AS PER APPROVED DRAWING	REFERE REC CONSTRUCTION STANDARDS	SITE REGISTER	
		2) IDENTIFY THE TRANSFORMER NEUTRAL TERMINAL, LATERMINAL AND OTHER ACCESSORIES	A	VISUAL	100%	AS PER APPROVED DRAWING	REFERE REC CONSTRUCTION STANDARDS	SITE REGISTER	
16	PIPE TYPE EARTHING INSTALLATION OF DP STRUCTURE	1) EXCAVATION OF PIT SIZE	C	VISUAL	100%	AS PER APPROVED DRAWING	REFERE REC CONSTRUCTION STANDARDS J2	SITE REGISTER	
		2) INSTALL 40 DIA GI PIPE WITH 12 DIA HOLES IN THE PIT	C	VISUAL	100%	AS PER APPROVED DRAWING	REFERE REC CONSTRUCTION STANDARDS J2	SITE REGISTER	

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		3) FILL THE PIT WITH ALTERNATE LAYERS OF 300 mm CHAR COAL AND SALT	A	VISUAL	100%	AS PER APPROVED DRAWING	REFERE REC CON- STRUCTION STAN- DARDS J2	SITE REGISTER	IN CASE OF THE ORDINARY SOILS WHERE PIPE COULD HAMOURED IN, TREAT- MENT OF THE PIT WITH CHARCOAL AND SALT IS NOT NECESSARY
		4) CON- NECTIONS BETWEEN THE PIPE AND POLE WITH 8mm SWG WIRE	C	VISUAL	100%	AS PER APPROVED DRAWING	REFERE REC CON- STRUCTION STAN- DARDS J2	SITE REGISTER	
		5) CONNECT THE EQUIP- MENT TO BE EARTHED AND THE PIPE EARTHE TERMINALS WITH GI WIRE	C	VISUAL	100%	AS PER APPROVED DRAWING	THERE SHOULD NOT BE ANY LOOSE CON- NECTIONS	SITE REGISTER	
17	TESTING OF EARTH RESISTIV- ITY	TESTING OF EARTHING	A	TEST	100%	STANDARD PRACTICE	INSTRUCTION MANUAL	SITE REGISTER	
SECTION - VII : ERECTION OF DANGER BOARDS AND ANTICLIMBING DEVICES									
18		1) FIXING OF DANGER BOARDS	C	VISUAL	100%	INSTRUC- TION MANUAL	APPROVED DRAWINGS AND REC SPECIFICA- TION NO 57	SITE REGISTER	THE LANGUAGE OF LETTERINGS SHALL CONFIRM TO RULE NO 35 OF IE RULES 1956 AND SHALL BE IN HIN- DHI OR ENGLISH AND IN LOCAL LANGUAGE WITH SIGN OF SKULL AND BONES

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		2) ERECTION OF ANTI CLIMBING DEVICES - BARBED WIRE	C	VISUAL	100%	INSTRUCTION MANUAL	APPROVED DRAWINGS	SITE REGISTER	
SECTION - VIII : ERECTION AND COMMISSIONING OF LT DISTRIBUTION BOXES									
19	INSTALLATION	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHALLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHALLAN	STORES REGISTER	COMPONENTS WHICH ARE INSPECTED AND CLEARED SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%	APPROVED DRAWING	DAMAGED COMPONENTS SHALL BE STACKED SEPARATELY	STORES REGISTER	MAJOR DAMAGED MATERIAL SHALL BE DISCARDED.
		3) PROPER STORAGE	C	VISUAL	100%	UTILITY REC SPECIFICATION or AS PER ACCEPTANCE NORMS	THE TRANSFORMERS AND THE ACCESSORIES SHALL BE STACKED ON DRY LEVELLED AND RAISED PLATFORM. ALL PIPE WORK, CONSERVATORS, RADIATORS SHOULD BE STORED WITH THEIR BLANKING PLATES IN POSITION. HEATERS IN THE MARSHELLING BOX SHOULD BE KEPT ENERGIZED TO AVOID CONDENSATION	STORES REGISTER	
		4) ERECTION OF LT DISTRIBUTION BOXES	C	VISUAL	100%	STANDARD PRACTICE	AS PER APPROVED DRAWINGS	SITE REGISTER	

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		2) ERECTION OF ANTI CLIMBING DEVICES - BARBED WIRE	C	VISUAL	100%	INSTRUCTION MANUAL	APPROVED DRAWINGS	SITE REGISTER	
SECTION - VIII : ERECTION AND COMMISSIONING OF LT DISTRIBUTION BOXES									
19	INSTALLATION	1) RECEIPT AT STORES	C	VISUAL	100%	DELIVERY CHALLAN	CORRELATION OF THE LOT RECEIVED WITH THE DELIVERY CHAL- LAN	STORES REGIS- TER	COMPONENTS WHICH ARE INSPECTED AND CLEARED SHALL ONLY BE ACCEPTED ON RECEIPT
		2) VISUAL INSPECTION	C	VISUAL	100%	APPROVED DRAWING	DAMAGED COMPO- NENTS SHALL BE STACKED SEPARATELY	STORES REGIS- TER	MAJOR DAMAGED MATERIAL SHALL BE DISCARDED.
		3) PROPER STORAGE	C	VISUAL	100%	UTILITY / REC SPECI- FICATION or AS PER AC- CEPTANCE NORMS	THE TRANSFORMERS AND THE ACCES- SORIES SHALL BE STACKED ON DRY LEVELLED AND RAISED PLATFORM. ALL PIPE WORK CONSERVA- TORS, RADIATORS SHOULD BE STORED WITH THEIR BLANKING PLATES IN POSITION HEATERS IN THE MARSELLING BOX SHOULD BE KEPT ENERZIZED TO AVOID CONDENSATION	STORES REGIS- TER	
		4) EREC- TION OF LT DISTRIBUTION BOXES	C	VISUAL	100%	STANDARD PRACTICE	AS PER APPROVED DRAWINGS	SITE REGISTER	

S. NO	MAIN ACTIVITY & OPERATION	CHARACTERISTICS/ INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK - Engineer-in-Charge	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	RE MARKS
		5) EARTH-ING OF LTDB	B	VISUAL	100%	STANDARD PRACTICE	AS PER APPROVED DRAWINGS	SITE REGISTER	COVER OF THE BOX IS ALSO TO BE EARTHED BY WAY OF FLEXIBLE COPPER LINK OF SUIT- ABLE DIMENSION
	CLASS OF CHECK: A -- CRITICAL B -- MAJOR C-- MINOR								
NAME/ SIGNATURE OF THE CONTRACTOR/ ERECTION AGENCY									

FIELD QUALITY PLAN FOR CT & PT								
ITEM : ERECTION WORK								
SUB SYSTEM : CT/ PT								
DATE :								
Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Records"	Remarks
1	2	3	4	5	6	7	8	9
1	RECEIPT & STORAGE							
1.1	Receiving inspection (Completeness of documents, test certificates, instruction manual etc.)	V	-	B	100%	Delivery Challan & Specification	MRC / Check List	
1.2	Unloading	V	-	B	100%	Instruction Manual	-	
1.3	Visual examination for damage & defects	V	-	B	100%	Packing list / Instruction Manual	-	
1.4	Proper storage	V	-	B	100%	Instruction Manual	-	
2	PRE INSTALLATION							
2.1	Availability of instruction manual and drawing, lifting arrangement	V	-	B	100%	List of approved drawing / Instruction Manuals	-	
2.2	Availability of all materials	V	-	B	100%	Packing list, Approved drawing & Bill Of Material	-	
2.3	CT foundation	V	-	B	100%	Civil foundation drawing	-	
2.4	Vertically of support structure	V	-	B	100%	GA/ Structural drawing	-	
3	INSTALLATION							
3.1	Rating plate details	V	-	B	100%	instruction manual	Site record	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
3.2	Check that the C.T. have been installed in proper polarity (P1 & P2 position)	V	-	B	100%	As per EIC/SLD	-	
3.3	Check for the tightness of equipment base bolts with	V	-	B	100%	instruction manual	-	
3.4	Check overall alignment of C.T.	V	-	B	100%	instruction manual	-	
3.5	Check for the primary ratio connected as per requirement.	V	-	B	100%	Rating plate	-	
3.6	Earthing of support structure & CT frame.	V	-	B	100%	instruction manual	-	
3.7	Check provision of earthing and tightness of earthing connection.	V	-	B	100%	instruction manual	-	
3.8	Check for the tightness of clamps/connectors.	V	-	B	100%	instruction manual	-	
3.9	Check for secondary termination tightness and crimping of leads.	V	-	B	100%	instruction manual	-	
3.10	Check the cable tags and ferrules are provided	V	-	B	100%	Cable schedule	-	
3.11	Ensure that unused secondary core are correctly shorted.	V	-	B	100%	instruction manual	-	
3.12	R,Y,B identification	V	-	B	100%	-	-	
3.13	Check for oil leakages	V	-	B	100%	instruction manual / No leakages	Site record	

S. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
3.14	Check verticality of equipment on support structure	V	-	B	100%	instruction manual	Site record	
4	PRE COMMISSIONING							
4.1	Measure IR value using meggar		Megger	A	100%	instruction manual	TC	
	a. Primary to secondary cores and earth with 2.5 kV.	Test						
	b. Between secondary cores.	Test						
	c. Between secondary to earth.	Test						
4.2	Check polarity.	Test	Multimeter/ Dry cell	A	100%	instruction manual / SLD	TC	
4.3	Check for CT ratio by primary Injection method.	Test	Primary injection kit	A	100%	instruction manual	TC	
4.4	Magnetising curve	Test	-	B	100%	instruction manual	TC	
4.5	Final document review	-	-	B	100%	instruction manual/final document list	TC	
CONTRACTOR'S SIGNATURE			NAME & SIGN OF APPROVING AUTHORITY					

FIELD QUALITY PLAN FOR Control & Relay Panel								
ITEM : ERECTION WORK								
SUB SYSTEM : Control & Relay Panel								
Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
1	RECEIPT & STORAGE							
1.1	Receiving inspection (Completeness of documents, test certificates, instruction manual etc.)	V	-	B	100%	Delivery Challan & Specification	MRC / Check List	
1.2	Unloading	V	-	B	100%	Instruction Manual	Site record	
1.3	Visual examination for damage & defects	V	-	B	100%	Packing list / Instruction Manual	Site record	
1.4	Proper storage	V	-	B	100%	Instruction Manual	-	
2	PRE INSTALLATION							
2.1	Availability of instruction manual and drawing, lifting arrangement	V	-	B	100%	List of approved drawing / Instruction Manuals	Site record	
2.2	Availability of all materials	V	-	B	100%	Packing list, Approved drawing & Bill Of Material	Site record	
2.3	Panel installation space	V	-	B	100%	Control room detail	-	
3	INSTALLATION							
3.1	Rating plate details	V	-	B	100%	instruction manual	Site record	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
3.2	Verticality & levelling of panels on support structures.	Measure	-	B	100%	instruction manual	Site record	
3.3	Check earth bus connection	V	-	B	100%	instruction manual	Site record	
3.4	Check the floor leveling where the panels are to be installed.	V	-	B	100%	As per site conditionss	-	
3.5	Check the physical condition of the panels after opening the packing and verify the material as per BOM.	V	-	B	100%	Specification	Site record	
3.6	Ensure the panels are lifted using proper slings/ tackles.	V	-	B	100%	Erection manual	-	
3.7	Check the panels are levelled, aligned and erected properly.	V	-	B	100%	As per site conditionss	-	
3.8	Removal of top and side blanking plates.	V	-	B	100%	Approved panel drawing	-	
3.9	Inter panel wiring is completed as per drawing.	V	-	B	100%	Approved panel drawing	-	
3.10	Check the tightness of inter panel nuts and bolts, Main bus, earth bus connection etc.	V	-	B	100%	Approved panel drawing	-	
3.11	Checked for broken glass, switch handle, lamp cover etc.	V	-	B	100%	Approved panel drawing	-	
3.12	Glanding of external cables	V	-	B	100%	Approved panel drawing	-	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	QUANTUM OF CHECK - Engineer-in-Charge	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
1	2	3	4	5	6	7	8	9
3.13	Blanking of unused cable entry locks	V	-	B	100%	Approved panel drawing	-	
3.14	Proper sealing & locking arrangement of panel door	V	-	B	100%	Approved panel drawing	-	
4	PRE COMMISSIONING							
4.1	Circuit diagram check	V	-	B	100%	Approved panel drawing	TC	
4.2	Auxiliary power supply test	Test	Multimeter	B	100%	Approved panel drawing	TC	
4.3	Functional & operation test of fittings on the panels.	V	-	B	100%	Approved panel drawing	TC	
4.4	Relay settings as per recommendation	V	-	B	100%	Approved panel drawing	TC	
4.5	Scheme check	V	-	B	100%	Approved panel drawing	TC	
4.6	IR Value check	Electrical	Megger	A	100%	Instruction manual	site record	
4.7	Secondary injection test for relays	Electrical	Injection kit	A	100%	Instruction manual	site record	
4.8	Check minimum pick up & drop out voltage of all coils & auxiliary contacts	Electrical	Voltmeter	A	100%	Instruction manual	site record	
4.9	Final document review	V	-	B	100%	Approved panel drawing / Final document list	TC	
CONTRACTOR'S SIGNATURE							NAME & SIGN OF APPROVING AUTHORITY	
<p>Legends :</p> <p>"CLASS OF CHECK:</p> <p>A -- CRITICAL B -</p> <p>- MAJOR</p> <p>C--MINOR MRC:Material Reciept Certificate</p> <p>TC: Test Certificate</p> <p>EIC : Engineer In Charge</p> <p>V : Visual</p>								

ITEM : ERECTION WORK								
DC SYSTEM								
Sr. No.	CHARACTERISTICS / ITEMS	Type Check	of Instruments	Class	Quantum/ Frequency	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
1	2	3	4	5	6	7	8	9
1	RECEIPT & STORAGE							
1.1	Receiving inspection (Completeness of documents, test certificates, instruction manual etc.)	V	-	B	100%	Delivery Challan & NESCL Specification	MRC / Check List / DC / 06	
1.2	Unloading	V	-	B	100%	Instruction Manual	-	
1.3	Visual examination for damage & defects	V	-	B	100%	Packing list / Instruction Manual	-	
1.4	Proper storage	V	-	B	100%	Instruction Manual	-	
2	PRE INSTALLATION							
2.1	Availability of instruction manual and drawing, lifting arrangement	V	-	B	100%	List of approved drawing / Instruction Manuals	-	
2.2	Availability of all materials	V	-	B	100%	Packing list, Approved drawing & Bill Of Material	-	
2.3	Completion of civil / ventilation requirement of battery room.	V	-	B	100%	Control room detail	-	
3	INSTALLATION - BATTERY							
3.1	Rating plate details	V	-	B	100%	instruction manual	Site record	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	Quantum/ Frequency	Reference Documents & Acceptance Standard	Format Of Records	Remarks
3.2	Check availability of safety devices, water and first aid box.	V	-	B	100%	BOM / NESCL Specifcation	-	
3.3	Check installation of batteries and rack as per approved layout.	V	-	B	100%	Instruction Manual	-	
3.4	Check the specific gravity of the electrolyte prior to pouring in the cells.							
3.5	Check for availability of electrolyte level up to required level and there is no leakage.	V	-	B	100%	Instruction Manual	-	
3.6	Check alignment and level of each cell	V	-	B	100%	Instruction Manual	-	
3.7	Check for tightness inter cell connection and application of grease.	V	-	B	100%	Instruction Manual	-	
3.8	Check for provision of earthing and tightness of earthing connection. Ensure cell are not earth any where.	V	-	B	100%	Instruction Manual	-	
3.9	Check all cell no. are properly fixed and are visible.	V	-	B	100%	Instruction Manual	-	
3.10	The cabling from Battery Charger to first, last and tap cells is completed.	V	-	B	100%	Instruction Manual	-	
3.11	Check all the cells are connected in correct polarity.	V	-	B	100%	Instruction Manual	-	
3.12	Painting of battery stand	V	-	B	100%	Instruction Manual	-	
4	INSTALLATION BATTERY CHARGER	-						

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	Quantum/ Frequency	Reference Documents & Acceptance Standard	“Format Of Records”	Remarks
4.1	Rating plate details	V	-	B	100%	instruction manual	Site record	
4.2	The quantity, ratings, type and make of the devices are as per the BOM as given in approved drawings.	V	-	B	100%	Instruction Manual	-	
4.3	No physical damages are there in any devices of the panels and replacement of damaged parts.	V	-	B	100%	Instruction Manual	-	
4.4	The inter panel Earth bus connections and connection to the earthing grid are tightened properly.	V	-	B	100%	Instruction Manual	-	
4.5	Fuses provided are of rating as shown in the approved drawings.	V	-	B	100%	Instruction Manual	-	
4.6	Check that the labeling of devices is as per the approved drawings.	V	-	B	100%	Instruction Manual	-	
4.7	Check the wiring is completed as per the approved drawings.	V	-	B	100%	Instruction Manual	-	
4.8	External cabling and termination with glands is completed as per the Cable schedule.	V	-	B	100%	Instruction Manual	-	
4.9	Cable tags, ferrules for cores are provided as per cable schedule.	V	-	B	100%	Instruction Manual	-	
4.10	Dressing and clamping of cables is done properly.	V	-	B	100%	Instruction Manual	-	

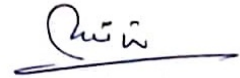
Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	Quantum/Frequency	Reference Documents & Acceptance Standard	Format Of Records	Remarks
4.11	Check the phases sequence of the Mains supply to the battery charger.	V	-	B	100%	Instruction Manual	-	
4.12	Check functioning of all relays/meters/selecter switches etc.	V	-	B	100%	Instruction Manual	-	
4.13	All alarms & annunciations, indications are functioning properly.	V	-	B	100%	Instruction Manual	-	
4.14	Check the Float & Boost charger operation, set the o/p voltage (if reqd).	V	-	B	100%	Instruction Manual	-	
4.15	Check the current limiting feature of charger & set the current limit (if reqd).	V	-	B	100%	Instruction Manual	-	
4.16	IR Value check	Measure	-	A	100%	Instruction Manual		
5	PRE-COMMISSIONING							
5.1	Check that all the assembly activities are completed.	V	-	B	100%	Instruction Manual	TC	
5.2	The cabling from Battery Charger to first, last and tap cells is completed.	V	-	B	100%	Instruction Manual	TC	
5.3	Check the polarity of the DC connection from Battery charger to Battery.	Test	Multimeter	B	100%	Instruction Manual	Site Record	
5.4	Check that the charging & discharging cycle is completed as per guidelines of manufacturer to prove battery AH capacity at 10 hr discharge rate.	V	-	A	100%	Instruction Manual/IS 1651	TC	

Sr. No.	CHARACTERISTICS / ITEMS	Type of Check	Instruments	Class	Quantum/ Frequency	Reference Documents & Acceptance Standard	"Format Of Records"	Remarks
5.5	Recharge	Electrical	-	B	100%	Instruction Manual	Site record	
5.6	Final document review	V	-	B	100%	Approved panel drawing / Final document list	TC	
<div> <div>CONTRACTOR'S SIGNATURE</div> <div>NAME & SIGN OF APPROVING AUTHORITY</div> </div>								
<p>Legends : "CLASS OF CHECK: A -- CRITICAL -- TO BE WITNESSED BY NESCL SITE AND SURVEILLANCE BY NESCL, CC. B - - MAJOR -- TO BE WITNESSED BY CONTRACTOR AND NESCL SITE C -- MINOR -- TO BE WITNESSED BY CONTRACTOR AND SURVEILLANCE BY NESCL SITE" TC : Test Certificate MRC : Material Receipt Certificate V : Visual EIC : Engineer In Charge</p>								

NOTE

This Handbook has been approved by Public Works Department, Govt. of Himachal Pradesh vide letter no. PW-CTR-29-/IQCS/2020-21/0252-53 dated 05/07/2021 and minutes of meeting no. PW/CTR-29-QCS/2020-21-297-10306 dated 05/07/2021. However, the provisions in the relevant manuals & IS Codes with upto date amendments shall supercede the provisions in this handbook in case of any variation.

For WAPCOS Ltd.



(Sumitt Mittal)
Addl. Chief Engineer & Project Manager
Chandigarh Office