JHA on Erection of Transmission Towers Lines and Stringing.

1. Engineer - in - Charge : NTPL
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Anchoring hook, come-along clamp, dynamometer, tractor wire rope/sling along with clamps, tower crane mobile crane.
4. PPE required : Helmet, shoes, cotton boiler suit, full body harness, suspended platform, safety net, insulated gloves
5. Authorization Required : Height pass to performers.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Receipt, storage and handling of galvanized structural steel Section, nuts and bolts.	a) Accident due to sharp edges of structural steel.	1. Ensure that sharp edge of angles/structural steel should be not be there. 2. Rubber hand gloves to be used for handling.
		b) Accident due to non-testing of cranes lifting tools and accessories.	1. Handling tools such as tower cranes and mobile crane should be duly tested and checked periodically for healthiness of the machine and certified by competent person. 2. Wire ropes and slings should be without joints should be inspected and certified by competent person.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Accident due to blockage of passage.	1. While moving the large consignment of material, blockage of road should be avoided and signal red/green flag should be used.
		d) Accident due to improper handling of loose materials.	1. Gunny bags should not be used for site transportation. 2. Plastic/metallic container (sealed from top) with proper lifting mechanism should be used. 3. Rigger and signal man and crane operator should be trained and qualified. 4. While handling materials, rigger, signal man and crane operator should be in communication and they should use standard signals.
		e) Accident due to improper stacking of materials.	1. Uneven stacking of material should be avoided. 2. Material should be stacked on proper sturdy and stable platform and level ground concrete.
2.	Erection of tower	a) Risk of falling from height.	1. Personnel should have height passes for working at height. 2. Personnel should beexperienced and should use full body harness and helmet. 3. Full body harness should be properly clamped tied to lifeline or sturdy objects. 4. Use step bolts on tower leg for climbing. 5. Use fall arrestors in addition to life line.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			6. Provide safety net below the area of work. 7. Personnel to be given rest ateach stage of work and blood pressure of personnel to be checked regularly. 8. Stop working at night and during heavy rains and wind.
		b) Risk of falling of structure.	1. Suitable stay wire should be used to prevent falling of structure due to wind and tilting of structure due to any other reasons. 2. All bolts should be tightened properly. 3. Restrict entry to work area by barricading/cordoning and caution signage.
3.	Erection of line and stringing.	a) Accident due to falling of conductors.	1. Insulator used should be free from any defect. 2. While laying the conductor, insulator, cross arm, tools, jigs, clamp to be used should be free from defects. 3. Restrict entry to work area by barricading/cordoning and caution signage.
4.	Stringing of conductor	a) Accident due to breakage of conductor or slippage of conductor and cross arm.	1. Come along clamp should be defect free. 2. There should not be any slippage while measuring the stringing strength by dynamometer. 3. Tension given to conductor should not be more than specified.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Cross arm should be firmly bolted/tightened. 5. Person engaged should be highly skilled and experiencein similar jobs. 6. Fully assembled insulator string to be verified for proper locking of pins before hoisting. 7. Height barriers/caution plate should be provided wherever transmission lines are crossing the road to restrict and caution any cranes or tall equipment crossing the line. 8. Guard should be provided below the transmission line on the portion of road crossings.

JHA on Erection of Transmission Towers Lines and Stringing Work.	Rev. No.	Doc. No:	Page 4 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection of Heavy Equipment in Switch Yard.

1. Engineer - in - Charge : *NTPL*
6. Manpower required for the job : AT SITE WORK
2. Tools and tackles required : Mobile crane, slings, D shackle scaffolding, laddes, required size spanner etc.
3. PPE required : Full body harness, safety helmet, hand gloves, shoes cotton boiler suit.
4. Authorization Required : Crane operator should have valid license, Height pass, scaffolding certification.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Position the crane.	a) Accident due to collision with personnel/ equipment.	1. Signal man should be trained person. 2. Ensure proper communication between Carne operator and signal man. 3. Entry to work area should be restricted by barricading/ cordoning and caution signage.
		b) Toppling of crane due to uneven ground surface or uneven loading.	1. Ensure that no person stand near load handling area. 2. Marching route shall be clear, surveyed leveled and compacted.
2.	Putting sling and D shackle	a) Hand injury due to improper handling.	1. Use leather hand gloves. 2. Crane hook movement should be stopped while putting sling.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Ensure qualified supervision hat at time of putting D-shackles and sling.
3.	Loading & unloading of equipment	a) Fall of equipment due to breaking of D-shackle, sling and pulley.	1. Ensure inspection and certification of all slings and D-shackle by competent person before its use as per manufacturer's instruction/ NTPL guidelines. 2. Use required size of sling and D-shackle as per weight of load 3. D-shackle and slings should be tested and certified by competent person before use.
		b) Crane failure.	1. Ensure inspection and certification of cranes by competent person before use. 2. Never lift load above rated capacity of material handling equipment. 3. Before use of crane, check functioning of brakes.
		c) Injuries due to fall of material on person standing nearby.	1. Restrict entry to work area by barricading/cordoning and caution signage. 2. Ensure that personnel are standing away from job. 3. D-shackle and slings should be tested and certified by competent person before use.
		d) Injury due to caught in between the objects.	1. Wear leather hand gloves, safety shoe. 2. Restrict entry to work area by barricading/cordoning and caution signage.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		e) Collision of lifted material with other material resulting in material damage.	1. Tag line should be tied to the lifting material. 2. No one should be allowed to stand below the lifted load.
			3. Area should be clear and barricaded with a caution board. 4. Deploy qualified crane operator, rigger and signal man.
4.	Removing of sling, D-shackle.	a) Injury to finger/hand.	1. Remove slings and D-shackle carefully. 2. Use leather hand gloves.
5.	Placement of equipment	a) Toppling of equipment due to improper placing.	1. Before removing the slings/D-shackle, the equipment should be fixed in foundation bolts. 2. Scaffolding for the job should be inspected and certified for use.
		b) Injury to person.	1. Use helmet, hand gloves, safety shoes.

JHA on Erection of Heavy Equipment in Switch Yard.	Rev. No.	Doc. No:	Page 3 of 3	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection of Gas Insulated Switchyard

1. Engineer - in - Charge : *NTPL*
7. Manpower required for the job : AT SITE WORK
2. Tools and tackles required : Mobile crane, truck, trolley, chain pulley block, wire rope slings, "D" shackle, wooden sleeper, Grinding M/c, Drilling M/c, Buffing M/c, Welding M/c, Spanner set, ladder, megger.
3. PPE required : Safety helmet, safety shoe, face shield, welder shield, leather hand gloves, full body harness
4. Authorization Required : Height pass, Certification of scaffolding platform

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Loading, shifting and transporting of GIS Equipment.	a) Falling of material on foot	1. Use safety shoes while lifting the equipment 2. Ensure safe working load of the lifting tools & tackles used for handling. 3. Restrict entry to work area by barricading/cordoning & caution signage.
		b) Failure of lifting tools & tackles.	1. Ensure inspection and certification of materials handling equipment before use. 2. Assess the capacity of lifting tools & tackles for safe works. 3. Test certificate of lifting tools & tackles to be checked. 4. Handmade sling should not be used.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Damage to equipment	d) Any moving and sensitive part of the equipment shall be protected.
2	Placing of materials & equipment at work location.	a) Collapse of equipment	1. Before placing the wooden sleeper ensure surface of the ground and ensure equal size, length of the wooden sleepers and distance between the wooden sleepers to be checked andmaintained.
		b) Occupying excessive place due to improper stacking & subsequent tilting or toppling.	1. Type and condition of the equipment must be known and stack them accordingly as per IS - 7969-1975
3	Handling GIS equipment manually and mechanically	a) Strains and sprains	1. Ergonomics of manual material handling should be followed for shifting, placing and handling of materials.
		b) Personnel injury	1. Ensure use of leather hand gloves and safety shoes.
		c) Personnel injury due to sharp edges.	1. Sharp and protruding edges of equipment and structure must be covered or removed.
		d) Poor Illumination	1. No work shall be carried out in dark and poor illumination. 2. Ensure illumination as per statutory requirements.
		e) Poor access to work location	1. Ensure suitable access to work location during erection.
5	Welding and cutting	a) Personal injury due to burns from weld splinters.	1. Ensure use of PPE strictly. 2. Perform job with hot workpermits 3. Persons working at 2.5 m and above height should have valid height pass and they shall wear full body harness while workingat height. 4. Provide safety net.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			5. While cutting and welding work is carried out at height, precaution should be made to prevent the fall of weld splinters below.
		b) Burn due to hot metal.	1. Ensure that the metal is cooled before working on it. 2. Restrict the personal movement by barricading/cordoning and caution signage.
		c) Fire hazard due to weld splinters.	1. Take hot work permit. 2. Ensure fire watch. 3. Precaution should be taken to collect the fall of weld splinters 4. Good housekeeping to be ensured & all combustible materials must be isolated. 5. Keeping fire extinguisher nearby welding & cutting spot for emergency use.
		d) Suffocation due to mild fumes.	1. Ensure ventilation during work.
6	Grinding and drilling	a) Breakage of grinding wheel.	1. Usage of quality wheels to be ensured. 2. Expiry date on wheels should be checked. 3. Ring test should be carried out before use. 4. Ensure periodic inspection of grinding wheel. 5. Check the direction of rotation of grinding wheel. 6. Specification of grinding wheel should be such that RPM of grinding wheel is more than that of machine shaft.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Injury to human body	1. Use goggle boiler suit other and relevant PPEs. 2. Hand gloves shall not be used while performing grinding and drilling.
		c) Electric shock due to improper cable joint damaged cables and improper grounding / Insertion of bare wires.	1. Before using any electric equipment, check supply cables for joints and any other damage of cables, continuity of earth connection. 2. All electric tools and equipment to be checked periodically for its IR value and handing inspection tag. 3. Ensure earthing of electrical equipment. 4. Power supply to power tools must be taken through ELCB. 5. Plug tops shall be used and nobare wire shall be inserted inside the sockets.
		d) Injury to eye	1. Ensure use of face mask/goggles.
		e) Shock from machines	1. Check the machines are dry before use. 2. Do not leave machines in damp place or in open, exposed to rain/curing water.
7	Installation of GIS equipment	a) Failure of lifting tools & tackles being used.	1. All tools & tackles must be inspected and tested routinely by competent persons.
		b) Fall of person	1. Life line has to be tied and full body harness must be hooked on life line, while moving on the structural members horizontally. 2. Persons working at 2.5 m and above height should have valid height pass. 3. Provide safety net. 4. Scaffolding and ladders erected for performing works should be certified for use and tagged.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Fall of materials	1. No work shall be carried out under the locations where works are going on at elevation. 2. Restrict entry to area below the work by barricading/cordoning and caution signage. 3. No loose/unwanted material shall be kept on the working platform. 4. Provide safety nets. 5. Tools like spanner etc. shall be hooked to belt or hands or carried in tools bags.
8	Handling of SF_6 Gas equipment	a) Skin irritation, heavy breathing and ingressof fluorides in eyes.	1. Prohibit smoking, drinking and eating in premises, where the SF6 equipment is located and especially during its operation. 2. Irritation area to be washed carefully by 5% solution of drinking soda, laundry soap, or rinse for 15 minutes underrunning water. 3. If anybody experiences heavy breathing problem, he should be immediately taken out in the open and he should sit quietly or lie down. If weakening of the breath take place connect with an artificial respirator and continue it till the doctor arrives. 4. On ingress of Fluorides in eyes, immediately wash eyes by 5% solution of drinking soda or pure water. If there is an odour nuisance, the combined exhaust and inlet ventilation should be switched on.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			5. In case of heavy leakage of SF6 Gas, arrangement for evacuation pre planning to be made to escape from the sub-station. 6. Switch on permanently the combined exhaust / inlet ventilation if the work is in basement, cable chambers and in other low lying areas where the possibility of SF6 gas getting settled.
9	Testing and commissioning	a) Electric shock	1. Before testing, loose material if any inside the equipment shall be removed. 2. Ensure authorized person are engaged for electrical related works. 3. Use appropriate megger for checking IR value. 4. Earthing of GIS equipment and structures shall be done properly as per norms. 5. After IR value measurement, equipment should be dischargedto prevent electric shock. 6. Ensured supervision by execution engineer.

JHA on Erection of Gas Insulation Switchyard.	Rev. No.	Doc. No:	Page 6 of 6	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection of Auxiliary Transformers and Main Transformers

1. Engineer - in - Charge : *NTPL*
8. Manpower required for the job : AT SITE WORK
2. Tools and tackles required : Mobile crane, Trailor, Red flags, caution tapes, wooden sleepers, skid rollers, chain pulley block, slings, D shackles, Nylon ropes, scaffolding and ladders.
3. PPE required : Safety shoes, leather hand gloves, full body harness, safety helmet, cotton boiler suit.
4. Authorization Required : Authorization for crane operators, riggers and signal men, Height pass for workers, certification of scaffolding, confined area entry permit.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Lifting and placing the Transformer with the help of Mobile crane on the Trailor.	a) Fall of transformer	1. Crane and lifting tools and tackles should be inspected and load tested by competent person. 2. Deploy authorized and trained crane operator, rigger and signal man.
		b) Hitting nearby material /equipment.	1. Standard signaling to be ensured. 2. Deploy authorized and trained crane operator, rigger and signal man. 3. Restrict entry to the work area by barricading/cordoning and caution signage.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Breakage of the equipment handling accessories.	1. Only load tested wire rope and D shackles should be used. 2. Restrict entry to the work area by barricading/cordoning and caution signage. 3. Ensure that experienced and qualified operator, rigger and signalman are deployed for the job.
		d) Injury to persons.	1. Restrict entry to the work area by barricading/cordoning and caution signage.
2.	Transportation of transformer	a) Toppling of the vehicle and equipment leading to accident	1. Ensure speed limit for the trailor speed should be below 5 km/h. 2. Make sure that road is leveledand compacted clear. 3. Continuous observation of the equipment during transportation by deployment of dedicated observer/persons. 4. Ensure good condition of Trailor and road. 5. Ensure that operator, rigger and signal man are trained, qualified and experienced.
3.	Shifting Transformer from Trailor to Location	a) Slippage of the transformer.	1. Check the access to approach. 2. Review the procedure of shifting and initiate necessary measures.
		b) Fall of transformer.	1. Ensure that operator, rigger and signal man are trained, qualified and experienced. 2. Ensure proper communication between crane operator, rigger and signal man. 3. Remove the ropes only after the trailer is in leveled position.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Breakage of sling.	1. Sling should not be loaded above the safe working load. 2. Sling should be inspected, load tested and certified by competent persons. 3. Area should be barricaded and unauthorized person should notbe allowed to enter the area.
		d) Injury to body parts.	1. Use leather hand gloves.
4.	Erection transformer on foundation	a) Slip of transformer.	1. Load tested material handling tools should only be used.
		b) Fall of Transformers.	1. Check proper approach to shift on location. 2. Ensure that operator, rigger and signal man are trained, qualified and experienced. 3. Use wooden sleepers wherever required. 4. Inspect hydraulic jacks for proper position. 5. Do job only in day time or with adequate lighting.
		c) Cut injury	1. Full body harness, safety shoes, safety helmet and leather hand gloves should be used.
5.	Installation of transformer accessories	a) Falling of accessories at the time of lifting.	1. Ensure proper fastening with rope and then lift. 2. Ensure that operator, rigger and signal man are trained, qualified and experienced. 3. Tested chain pulley block should be used for inserting transformer bushing.

JHA on Erection of Auxiliary Transformers and main Transformers.	Rev. No.	Doc. No:	Page 3 of 5	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Cut injury	1. For line control of up and down movement of accessories another tested chain pulley block should be used. 2. Skilled man power should deploy for the job.
		c) Fall of persons from height.	1. Full body harness should beused. 2. Persons working 2.5 m and above shall have valid height pass. 3. Scaffolding should be used for connection of bushing and installation of conservator on top of transformer. 4. Scaffolding and platform should be inspected and certified for use.
6.	Internal inspection before filling oil in transformer	a) Slip and fall of the person in side transformers.	1. Skilled person should only enter inside transformers for inspection. 2. Confined area entry permit should be taken. 3. Effective communication should be available while the person is inside.
		b) Unconsciousness in side transformer.	1. Check atmosphere inside for adequate (>19.5%) oxygen. 2. Ventilate the area with forced air circulation. 3. Provide adequate lighting (> 100 lux). 4. If person feels uneasy ask him to come out immediately.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
7.	Filling of oil if transformer is oil tank.	b) Fire Hazard	1. Mulsi-fire system should be commissioned before filling oil in the transformer. 2. At time of oil filling and after filling no welding and cutting work should be allowed near the transformer.
		a) Slipping the person due to spillage of oil.	1. Before filling with oil carry out leak test of transformer oil tank. 2. Before filling of oil ensure that all valves of transformer areclosed. 3. Stop oil filling if oil leakage/seepage is observedfrom any points. 4. Clean oil from floor before starting job. 5. Stop oil filling machine immediately. 6. Area should be barricaded and unauthorized person should not be allowed to enter the area.

JHA on Erection of Auxiliary Transformers and main Transformers.	Rev. No.	Doc. No:	Page 5 of 5	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection, Testing and Commissioning of 6.6KV SWGRS, 415V SWGRS, 415V Distribution boards/motors control centres/chargers/UPS.

1. Engineer - in - Charge : *NTPL*
9. Manpower required for the job : AT SITE WORK
2. Tools and tackles required : Megger, multi meters, tong tester, earthing rod with leads, BDV kit, TTR, proximity tester.
3. PPE required : Helmet, Hand gloves, Shoes (Insulated), full body harness.
4. Authorization Required : Electrical Authorization to the working Personnel, Qualified and authenticated engineers supervisors and technicians are required, certification of scaffolding

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Lifting & placing of panels by the help of Mobile crane or Manual shifting	a) Fall of material	1. Effective communication facilities must be made available and used for doing the work. 2. Load tested Mobile crane should be used. 3. Only authorised and trained crane operator, rigger and signal man should be deployed.
		b) Hitting nearby material/ equipment.	1. Ensure standard signaling/ communication. 2. Depute experienced Rigger. 3. Use leather hand gloves,safety shoes, safety helmet and full body harness.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Breakage of the material handling tools.	1. Only load tested material handling tools should be used. 2. Restrict access of the area by barricading/cordoning and caution signage.
2.	Transportation of panel.	a) Toppling of the vehicle and equipment leading to accident.	1. Ensure speed limit for the Trailers (below 6 km/hour and Truck speed should not be more than 20 km/hr. 2. Make sure that road is clear. 3. Ensure continuous observation during the transportation of theequipment by deployment of dedicated observer/person. 4. Ensure good condition of Trailer and road. 5. If material is protruding outside the Trailor, red flag /red lamp should be displayed on the trailor.
3.	Shifting of panel to the site	a) Slip/tilting of panel	1. Check the access and approach. 2. Use proper tool for shifting.
		b) Fall of panel	1. Trained and authorized crane operator, rigger and signalman should be deployed.
		c) Breakage of sling.	1. Safe unloading area to be maintained. 2. Restrict entry to area by barricading/cordoning and caution signage. 3. Load tested material handling tools should only be used.
4.	Erection of panel	a) Accident due to unused opening after erection of panel.	1. All unused opening/left out opening should be closed by means of plate or barricading.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Damage of equipment/ instrument on panel due to falling or any other means.	1. Before starting welding ensure that all instruments/ equipments which can get damaged/ affected by heat are removed 2. Protecting covers should be provided so that components are not getting damaged while doing erection work.
		c) Breakage of component due to falling of equipment.	1. No loose/unwanted component should kept above the equipment. 2. Safety net should be provided above the equipment. 3. All components should be firmly installed/bolted.
5.	Testing of panels	a) Accident due to improper use of testing instruments.	1. Insulated hand gloves should be used. 2. Instruments of proper range and accuracy should be used. 3. IR & HV test of electronic circuit should not be done.
6	Commissioning of panels.	a) Accident due to lack of coordination during commissioning.	1. Responsibility of personnel should be clear and concise. 2. Commissioning should be carried out as per approved procedure. 3. Work should be taken up in sequential manner and at the same time all the pre-requisite should have been completed.
		b) Accident due to shared/dual responsibility.	1. Two groups generally should be avoided on the same job. 2. In case two groups are deployed, coordination should be ensured by appointing a coordinator with briefing.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Work permit should be obtained. 4. Job should be carried out as per approved procedure. 5. Detailed planning on day today activities should be made and endorsed by an experienced senior engineer. 6. Effective communication should be ensured among all groups. 7. Daily sectional meeting at engineer's level and group meeting up to supervisor's level should be conducted to bring up a common understanding of the issues and plan. 8. Walkie-talkie system/ telephone gadget should be available in the field for effective work at technician level.
		c) Accident at the first time charging of equipment.	1. Just prior to charging of equipment high voltage test and IR value should be checked before and after HV test at the specified value. 2. Before the HV test the equipment/panels should be thoroughly inspected for any foreign material presence inside. 3. All panel doors should be in closed condition.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. All pre-commissioning / commissioning test should be carried out as perspecification and approved procedures. 5. Electrically authorized work on the equipment/system. 6. All statutory clearance should be taken before energizationof switch gears/panel statutory clearances should be taken from Regional office of Central electricity authority.
		d) Accident due to wrong sequence of charging or non-performing of primary injection test.	1. Primary injection test shall be carried out before charging of equipment/panel to check protection/relay function. Approved sequence of charging should be followed. 2. All safety precautions as laid down in commissioning procedure should be takencare while rack in and rackout of the breaker. 3. Persons with electrical authorization shall work on the equipment/ system.

JHA on Erection, Testing and Commissioning	Rev. No.	Doc. No:	Page 5 of 5	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Installation of Permanent Lighting network-conduiting and lighting fixtures

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : A-frame platform Ladder, scaffoldings, portable drilling machines
4. PPE required : Safety helmet, full body harness, safety shoe, fall arrestor, life line
5. Authorization Required : Height pass

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Assembly of scaffolding	a) Fall from height	1. Choose a firm level area for scaffolding stand. 2. Persons work at 2.5 m above height should have validheight pass. 3. Wear full body harness and other PPEs. 4. While lifting of scaffolding materials good quality of rope shall be used. 5. Check the installation of side rungs at regular intervals for persons climbing up anddown easily. 6. Ensure out riggers ofscaffolding are properlytightened.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			7. Check the locking of scaffolding wheels. 8. Ensure easy access to the top by providing A-frame platform ladder/ scaffolding. 9. Ensure tower platform of scaffolding placed withoutany chance for slippage. 10. Install of cross bracings of adequate numbers for structural rigidity. 11. Provide safety net wherever required. 12. Scaffolding erection is to be certified by company's competent authority.
2	Marking for conduit installation	a) Fall of person	1. Valid height pass for workers 2. Use full body harness 3. Ensure rubber stoppers for the ladder 4. Ensure the scaffolding and working platform are certified and sufficient base width is provided for the scaffolding 5. Provide safety nets.
		b) Slippage of the ladder	1. Ensure 75^0 angle of inclination for the ladder 2. Ensure rubber stoppers for the ladder.
		c) Toppling of Scaffolding	1. Ensure sufficient base widthof the scaffolding 2. Ensure persons are not on the scaffolding while the scaffolding is shifted

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		d) Injury due to fall of material	1. Use safety helmets 2. Restrict the personnel movement in the working area by barricading/cordoning and caution signage.
3	Drilling for fixing of conduits/ fittings	a) Fall due to improper balancing of person	1. Use self supporting ladders 2. Ensure proper width of the working platform 3. Use full body harneseses
		b) Electric shock	1. Ensure proper Earthing of the tools 2. Ensure that ELCB is in the power circuit from where the power to the portable machines is drawn. 3. Check machines for possible wetness before using. 4. Do not leave machine indamp lace or in open exposed to rain/curing water.
4.	Conduit installation	a) Injury due to handling of conduits	1. Ensure that people are sufficiently away while handling the conduits. 2. Restrict the personnel movement in the working area by barricading/cordoning and caution signage.
5.	Installation of fittings	a) Slippage of the material	1. Use rope to lift the material 2. Ensure that persons are not standing below while lifting the material. 3. Restrict the personnel movement in the working area by barricading/cordoning and caution signage.

JHA on Installation Construction lighting.	Rev. No	Doc. No:	Page 3 of 3	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Maintenance Work on Substation and Switchyard

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : *NTPL* AT SITE WORK
3. Tools and tackles required : Megger, multimeter, tong tester, earthing rod with loads, BDV kit, TTR kit, micro ohm meter, cable fault locator, proximity tester
4. PPE required : Helmet, hand gloves, electrical safety shoes, full body harness, fall arrestor, lifeline
5. Authorization Required : Electrical authorization for supervisors and technicians, Height pass, certification of scaffolding/platform

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Maintenance work on Transformer.	a) Accident due to wrong identification of Transformer.	1. Work permit and authorization should be obtained. 2. Check to identify the correct Transformer. 3. Only authorized persons should be permitted for work. 4. Use Proximity tester
		b) Accident due to Electrocution.	1. Static Electrical charge must be discharged to ground through discharge rod before taking upthe maintenance work. 2. First-aid chart should be available in the sub-station. 3. Authorized persons list, First-aid chart, contact numbers of all important officials andconsumers should be available insubstation.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
2.	Maintenance work on a Breaker	a) Accident due to phase opposition closing of Breaker.	1. Remote closing and tripping or electrical closing and tripping with TNC switch only to be done with breaker doors in closed position.
		b) Accident at the time of rack in and rack out of Breaker.	1. Ensure that beaker room floor is adequately insulated. 2. Insulated hand gloves should be used for racking in and racking out of breaker.
		c) Accident at the time of closing of Breakers.	1. Dead bus closing should always be preferred. 2. While going for synchronization, preferably use 6 channel oscilloscope and dark lamp method in parallel to closing through synchroscope. 3. Frequency of calibration of synchronoscope should be at least after every 3 months.
3.	Maintenance work of Line cables and Isolators	a) Accident due to residual charge on line.	1. Static electric charge on line and isolators should be discharged to ground and when personnel are at work live parts of line or equipment.
		b) Accident due to inadvertent charging of line.	1. Maintenance work should be commenced after due authorization only. 2. Earthing switch should always be closed while Maintenance work is going on. 3. Appropriate tagging should be on all respective feeders and switches that "Personnel are at work" or Do Not Operate(DNO).

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
4.	Maintenance work on CVTs, PPE, CTs and Lighting arrestors.	a) Accident due to residual voltage	1. Work should be carried out after obtaining work permit. 2. Maintenance should be carried out with trained man power. 3. Always work should be done as per drawings/with the drawings and approved procedures.
5.	Hot line washing	a) Risk of electrocution or risk of short circuit fault/ ground faults or flashover or failure of insulators and other equipment	1. Hot line washing should be done by wearing all protections. 2. Before performing the hot line washing, wind direction shouldbe checked. 3. Washing operation should not be done in stormy weathercondition. 4. In semi automatic or automatic system of hot line washing water purifying should be done with water droplets only. 5. Continuous water spray should not be done on Insulators. 6. Always maintain a minimum clearance between hot line washer, equipment and working personnel. 7. Ensure periodic check on conductivity of water. 8. Ensure prevention of seepage of water to cable termination box/ T B of motor/motorized valves.
6.	Replacement of Insulators string	a) Risk of falling of person or accident due to falling of components/line or short circuit/ground fault	1. Ensure use of required PPEs. 2. Deploy qualified, trained and experienced man power for the job. 3. All tools should be tied to person while climbing up.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Safety net should be provided. 5. Step up leg bolts should be provided for climbing to towers. 6. Line should be properly alternately tied / clamped in safe manner. 7. Work permit system should be evolved. 8. Person working at 2.5 m height and above shall have valid height pass. 9. Authorized personnel should only be deployed on the job.
7.	Working on Emulsifier system of transformer	a) Risk of fire spreading due to non availability of emulsifier system	1. Whenever any shut down is taken on emulsifier systems alternate arrangement for fire suppression by deployment of Fire tender on the location must be ensured.

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JHA on Electrical Maintenance of Construction Power Supply Network/Lighting

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Cutting plier, spanner, screw driver and crimping tool, proximity tester, A-frame platform ladder.
4. PPE required : Safety shoes, electrical hand gloves.
5. Authorization Required : Work permit, Electrical Authorization, Height pass

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Replacement of fuses.	a) Electric shock	1. Ensure that work permit is taken. 2. Ensure that supply is switched off. 3. Test the supply in the line tester/test lamp. 4. Use proximity tester to identify live lines. 5. Use fuse puller for removing and replacement of fuses. 6. Avoid using screw driver etc for pegging out/pushing Fuses.
		b) Flash over	1. Avoid using screw driver for pushing the fuse which may slip and touch the line parts.
2.	Termination of cable	a) Electrical shock	1. Ensure the work permit is taken. 2. Test the power supply before using tester/test lamp. 3. Use proximity tester to identify live lines. 4. Use safety shoe.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
3.	Replacement of switch Fuse units.	a) Electric shock	1. Ensure job permit is taken. 2. Test the power supply before using tester/test lamp. 3. Use proximity tester to identify live lines. 4. Ensure that the power supply to the panel is switched off. 5. Use Safety shoes.
4.	Replacement of switch/socket/fan	a) Electric shock.	1. Ensure that the supply is switched off from the power source and Place caution Tag on it. 2. Test the supply with line Tester/ Test lamp 3. Use proximity tester to identify live lines. 4. Use Safety shoes.
5.	Panel maintenance.	a) Electric shock.	1. Ensure that work permit is taken by performers. 2. Test the power supply before work using Tester/Test lamp. 3. Use proximity tester to identify live lines. 4. Ensure the supply is switched off from the board at source and place caution tag on it. 5. Ensure use of safety shoes by workers.

JHA on Electrical Maintenance of Construction Power Supply Network/Lighting	Rev. No.	Doc. No:	Page 2 of 2	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection of Isolated Phase Bus Duct

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : marker, chain pulley, welding machine, helmet, scaffolding, nylon rope, D-shackle, slings.
4. PPE required : Safety helmet, safety shoes, full body harness, rubber hand gloves, leather apron and rubber mat.
5. Authorization Required : Height pass, Welder certificate, Test certificate for crane pulley block, D- shackle and slings.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Marking	a) Cut injuries in hand	1. Wear hand gloves. 2. Ensure proper supervision by a trained person. 3. Ensure proper lay out.
2.	Support welding in EP's	a) Person fall from height.	1. Ensure fixing of scaffolding is firm. Preferably use `A' Frame ladders. 2. Persons working at 2.5 m above height shall have valid height pass. 3. Use full body harness. 4. Use safety net to prevent persons falling. 5. Scaffolding and platforms shall be inspected and certified.
		b) Eye injury due to flash or light fromwelding.	1. Ensure use of welding helmet with face shield. 2. Unauthorized person should not be allowed to be in the area.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Burn injury due to falling of weld spatters.	1. Hand gloves and cotton Boiler suit should be used. 2. Barricade the area to prevent unwanted persons from entering the area. 3. Maintain distance from point.
		d) Electric shock due to lack of Insulation on welding cable.	1. Welding machine should be earthed with two separate Earth leads. 2. Before use check Insulation of welding cable. 3. Person should use rubber mat on ground, safety shoes and insulated hand gloves. 4. Ensure main supply is switch off. 5. To ensure power is off. Put caution tag to alert personnel.
		e) Electric shock at time of connection of machine.	1. Use rubber mat near connection panel. 2. Use rubber hand gloves. 3. Machine and supply panel should be earthed to two separate points. 4. Ensure that authorized electrician is carrying out the work. 5. Ensure that supply switch having 3 pin is properly connected. 6. Before connecting check Insulation Resistance of (IR valve) of Welding Machine. 7. Ensure welder uses specified PPEs.
		f) Suffocation due to welding.	8. Ensure proper ventilation during welding.
3)	Lifting Bus duct	a) Cut or crush injuries to Hand.	1. Use leather hand gloves. 2. Ensure the balancing of the duct.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Hit injury	1. Area should be barricaded. 2. At time of lifting three way communications should be used. 3. Ensure effective supervision of job.
		c) Injury to person due to slipping of chain block, failure of D-Shackle/sling.	1. Ensure inspection and testing of chain block shackle/sling and other lifting tools by competent persons before starting the job. 2. Tight the chain block with load capacity support. 3. Keep away persons at time oflifting the bus duct. 4. Restrict entry of persons by barricading /cordoning and caution signage.
		d) Injury due to fall ofnut bolt, and spanners.	1. Put nuts and bolts in box. 2. Tie spanners with thread. 3. Do not allow persons to work under the bus duct. 4. Use safety net.

JHA on Erection of Isolated Phase Bus Duct.	Rev. No.	Doc. No:	Page 3 of 3	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Handling of Electrical Equipment (Transformers, cable drums, panels and batteries)

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Mobile crane, Truck & Trailor, D-shackle, Sling & manila rope, chain pulley block, scaffolding and platform
4. PPE required : Safety helmet, Safety shoes, Full body harness and Hand gloves.
5. Authorization Required : Test certificate of crane, D-shackle, sling and valid License for crane operator, Height pass

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Moving of mobile crane on location.	a) Accident with workman	1. Qualified crane operator,rigger and signal man should be deployed for the job. 2. Proper communication should be established between crane operator, rigger and signalman before taking up the job. 3. Area to be cleared before shifting crane. 4. Restrict entry to the area by barricading/cordoning and caution signage.
		b) Toppling of crane	1. Overloading shall be avoided. 2. Soil stability/unevenness of area shall be checked before shifting crane on location.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Crane should be stand on wooden planks. 4. Signaling shall be ensured single person.
2.	Shifting the equipment	a) Fall of equipment from truck.	1. Tie the equipment with given hook or manufacturers guide. 2. Ensure that material handling tools and tackles are load tested and certified by competent person. 3. Use proper size of Rope/Sling. 4. Use proper size of Sling.
		b) Failure of lifting crane.	1. Inspect crane for proper load capacity and testing details as mentioned on the crane. 2. Ensure that the crane is tested and certified by competent person.
		c) Fall of work man due to improper approach of the crane.	1. Persons working at 2.5 m and above shall have valid height pass. 2. Ensure height permit is obtained. 3. Provide Safe Working Platform. 4. Ensure that scaffolding and platform are inspected and certified. 5. Arrange safety net at necessary location. 6. Conduct Induction Training to all workers. 7. Use full body harness.
3.	Erection of chain block.	a) Fall of chain pulley block	1. Ensure proper lashing/tying of chain pulley block with the structure before releasing the weight of block.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			2. Use only tested sling and D-shackle. 3. Engage only qualified skilled/ experienced rigger for the work. 4. Perform inspection of chain pulley block periodically as per procedure/checklist. 5. Apply lubrication on moving parts regularly.
4.	Lifting of cable drums.	a) Slipping of drums from sling.	1. Tie the sling in proper distance of pipe. 2. Length of sling should be equal in both of crane hooks. 3. Support cable drum by hand at time of lifting.
		b) Injury in Hand of person	1. Qualified signalman should be deployed. 2. Keep away, if possible at time of unloading drums. 3. Restrict entry to the area by barricading/cordoning and caution signage.
		c) Injury due to rolling of drums.	1. Ensure proper support at the time of unloading. 2. Restrict entry to the area by barricading/cordoning and caution signage. 3. Good housekeeping should be ensured.
5.	Loading and unloading of panels.	a) Fall of panel	1. Ensure maintenance and testing of all the lifting machines, tools and tackles. 2. Restrict entry to the area by barricading/cordoning and caution signage.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Good housekeeping should be ensured. 4. Safe working load shall be marked on all lifting machines, Tools and Tackles. 5. Review the plan and activities before taking up the work. 6. Fire protection measuresshould be provided in the area where the panel/equipment are stored.
		b) Caught in between object.	1) Ensure supervision. 2) Deploy qualified crane operator, signal man and rigger. 3) Crane operator, signal man and rigger should maintain effective communication. 4) Restrict entry to the area by barricading/cordoning and caution signage.

JHA on Handling of Electrical Equipment.	Rev. No.	Doc. No:	Page 4 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection, Testing and Commissioning of Batteries

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Multimeter tong tester, Megger, load bank, Hydro meter, Thermometer, Acid neutralizing agent, moping tool with water tray for keeping tools, Eye washers, Resistance bank, Hydrogen detector
4. ,PPE required : Helmet, safety shoes, hand gloves (insulated), Apron (plastic), Plastic/PVC shoes, goggles
5. Authorization Required : Qualified and trained personnel are required.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Storage and preservation of batteries and electrolyte containers.	a) Breakage of electrolyte containers and seepage of electrolyte.	1. Electrolyte container should be kept on leveled wooden platform and proper stack condition. 2. Container cap should be tightened and sealed. 3. Acid neutralizing agent should be kept in the room where electrolyte containers are kept. 4. Personal shower and eyewasher should be there in the room.
		b) Damage to battery container.	1. All holes of battery containers should be sealed.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			2. Battery should be kept in dust free environment. 3. Proper stacking should be done and Battery should be kept on level wooden platform.
2.	Shifting and transportation of Batteries and electrolyte containers	a) Spillage of electrolyte on human body or elsewhere.	1. Electrolyte containers should be handled with care so that it should not break during handling. 2. All safety/precaution measures such as plastic shoes, Apron and hand gloves should be used. 3. Neutralizing agent and water should be kept ready. 4. Trolley should be used for indoor shifting.
		b) Damage to Batteries	1. Battery should be always be lifted by putting the jigs at the bottom and not to be lifted through terminals. 2. Trolley should be used for indoor shifting and transportation.
3.	Electrolyte preparation	a) Accident due to improper mixing of electrolyte.	1. Always pour water into acid and not vice versa to prevent splashes of acid. 2. Mixing of water and concentrate acid should be incorrect proportion, as per specification.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
4.	Testing of batteries	a) Accident due to spillage of electrolyte.	1. When readings are taken with hydrometer it should be done with care and spillage should be avoided. 2. PVC trays should be used for keeping the hydrometer and thermometer.
		b) Accident due to electrical shocks.	1. Safety shoes should be mandatory for person entering in the battery room. 2. Insulated hand gloves should be used while touching the terminals/taking the voltage reading of cells.
		c) Accident due to evolution of excessive Hydrogen or increase in concentration of oxygen	1. Minimum six Air change per hour should be done in the Battery room by means of providing exhaust fan and adequate inlet air supply. 2. Hydrogen detectors should be installed in the room. In case hydrogen detectors are not installed measurement of hydrogen concentration in air to be carried out at a frequency of twice a day using Portable HydrogenDetector.
		d) Explosion/fire due to hot work in battery room.	1. All the hot work such aswelding and grinding, gas cutting should not be permitted in battery room after taking up Testing and Commissioning and in stageof operation and maintenance. 2. All the holes should beplugged when routine readings of the batteries had been taken.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Transparent container should always be used for batteries.
5.	Commissioning and operation of batteries	a) Damage to batteries due to excessive current drain.	1. Battery current limit should be provided to prevent excessive discharging of battery.
			2. Provide fire protection measures during charging/ discharging. 3. Monitor hydrogen evolution during battery charging 4. Battery cells should always be checked for ground fault/ leakage to ground and adequate care should be taken to minimize it.
		b) Damage to batteries due to excessive current during charging of battery.	1) Ensure battery current limits during battery charging.

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JHA on Cable Laying and Termination

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Tools for excavation, Cable lifting jacks, knife for cable peeling, proximity tester
4. PPE required : Full body harness, Safety helmet, hand gloves.
5. Authorization Required : Excavation permit, Electrical authorization

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Excavation for Cable laying	a) Shock from buried Cables.	1. The area to be excavated shall be carefully seen for possible Cables laid already by obtaining clearance from all concerned agencies. 2. Excavation permit shall be taken. 3. While excavating near the Cables, the Cables shall be de-energized. 4. Area around the Cable shall be excavated with utmost care. 5. Take precautions against presence of reptiles.
		b) Fall in excavated pits.	1. Hard barricading with caution signage shall be done to avoid fall into the excavated trenches.
2.	Loading and Unloading of cable drums ontruck.	a) Failure of slings.	1. Periodic examination, testing and certification of slings by competent person. 2. Use slings of correct capacity.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Keep persons at a distance while the material is being lifted/lowered.
		b) Failure of the Cranes.	1. Ensure periodic inspection and load testing of cranes by competent person 2. Ensure to use cranes of correct capacity. 3. Carry out periodic maintenance of Cranes.
		c) Fall of drums from the Truck.	1. Properly fasten the drums. 2. Block the movement of drums using wooden stoppers/ sleepers.
3.	Transportation of Cable drums.	a) Fall of Cable drums.	1. Speed limit of 20 km/hr shall not be exceeded. 2. Lock the movement of cable drums by fastening and with wooden stoppers/slippers.
		b) Over turning of the vehicle.	1. Use vehicle of adequate capacity. 2. Avoid over loading. 3. Negotiate curves at reduced speed.
4.	Unrolling of Cables.	a) Slippage of cable drum from jacks.	1. Properly balance the cable drums over the jack. 2. Check the ground below the jacks to be sufficiently firm to take the load 3. Avoid pulling of the cable for unrolling; instead rotate the cable drum for unrolling.
5.	Cable termination	a) Cut from knife while peeling the cable.	1. Care shall be taken while the Cable sheath is peeled off. 2. Canvas/leather hand gloves shall be used.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Cut from the cable armor while handling.	1. Canvas/leather hand gloves shall be used.
		c) Injury due to cable fall.	1. Use Safety shoes.
		d) Shock while termination	1. Before termination of theCable, ensure that the powersupply is cut off. 2. Ensure that job permit is taken. 3. Only experienced and electrical authorized persons shall be deployed. 4. Use proximity tester.
6.	Taking IR value/HV test	a) Shock hazard due to test voltage	1. Ensure that the persons are away from the Cable terminals while Meggering. 2. Ensure that the Cable terminals at the farther end and are safe and isolated from human approach/caution boards are put. 3. Discharge of Earth Cable before work. 4. Ensure that job permit is taken. 5. Only experienced and electrical authorized persons shall be deployed. 6. Use proximity tester.
		b) Shock hazard due to wrong identification of cable.	1. Ensure that the Cable ends are properly identified before start of work. 2. Check the presence of Voltage by line tester/test lamp for L.T. 3. Test for the presence ofvoltage by remote voltage indicator for HT.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Ensure that job permit is taken. 5. Only experienced and electrical authorized persons shall be deployed. 6. Use proximity tester.

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JHA on Erection of Cable Trays System

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3.
4. Tools and tackles required : Hydra, Cranes, Manila rope, chain pulley, lifting mechanism for heavy support scaffolding.
5. PPE required : Helmet, Safety Shoes, full body harness, fall arrestor and life line etc.
6. Authorization Required : Qualified welder, Trained Fitter and Riggers. Height pass, scaffolding certification

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Preparation of loading /unloading	a) Personal injury	1. Skilled workers should be deployed for work. 2. For long/heavy objects to be moved, ensure adequate number of personnel for assistance. 3. Area should be clear and access to unloading site should be clear. 4. Care should be taken to ensure safe unloading of the material, by way of using proper tools, tackles, Crane and lifting tools. 5. Ensure that crane and lifting tools and tackles are inspected and load tested by competent person.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
2.	Erection of cable Tray support	a) Fall of support/chances of fire/hand/foot hazard	1. Scaffolding and platform should be inspected and certified. 2. Scaffolding should be checked before work. 3. Scaffolding bracing, platform blanks (MS only) should be tied securely. 4. Lifting tool for the heavycable tray support should semi-automatic so that manual handling can be reduced. 5. Tools and Tackles for lifting the material should be tested and should be free from any defects. 6. Qualified and trained crane operator, rigger, signal man and fitters should be put onthe job. 7. The persons working at 2.5 m above height shall have valid height pass. 8. Use full body harness. 9. All the persons should use PPE irrespective of the work being carried out. 10. Provide adequate Illumination as per statutory guidelines. 11. Maintain good housekeeping. 12. Painted mild steel or stainless steel scaffolding should only be allowed.
3.	Erection of cable tray	a) Risk of falling of cable trays and injury due to sharp edges.	1. Lifting tools should be tested and free from defects. 2. Sharp edges should be removed before erection of cable trays.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Immediately after putting the cable trays on supports, J-bolts or cable tray clamp should be provided/installed. 4. Full body harness, Helmetand Safety shoes should be used for personal protection
4.	Head level Trays	a) Head Injury due to low height	1. Fix Fluorescent tape and soft padding on low/head level cable trays to caution working personnel.
5.	Erection of cable trays earthing	a) Risk of falling of earthing conductors and damage of cable due to hot work.	1. Hot work should be avoided after laying of the cables in trays. 2. If hot works are to be performed near cable trays cover it with fire resistant cloths. 3. Lifting tools should be tested and free from defect. 4. Any welding work on galvanized portion should be avoided.
6.	Erection of cable tray covers	a) Risk of damaging the LHS. Cable (If provided)	1. Cable tray covers should beput in such a manner that LHS cable which are very sensitive to heat or physical weight are not affected due to movement/handling and installation of cable tray covers.
		b) Damage to cables.	1. Care should be taken in such a way that edge of cable tray cover should not damage the laid cables.
		c) Human injury with sharp edge of cable tray cover and falling of cable tray covers.	1. Any sharp edge must be removed before starting the erection work.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			2. Centre of gravity should be ensured while lifting. 3. Tools and Tackles should be tested and should be free from any defects. 4. Immediately after installation of cable tray covers, it should be clamped.
7.	Earthing of trays	a) Risk of electrocution due to non-earthing of cable trays.	1. All cable trays should be earthed at both ends and at regular intervals for long run of cable trays.
8.	Floor openings of cable trays	a) Risk of falling into the opening	1. Cable tray openings on floor to be well guarded barricaded. 2. Cable tray openings should be filled with fire stop materials.

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JHA on Installation of Street Lighting

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Crane, truck, lifting slings, D-shackles, tie ropes, A-frame platform ladder
4. PPE required : Safety shoe, hand gloves. Full body harness
5. Authorization Required : Valid Height passes to workers.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Loading & unloading of poles.	a) Failure of slings while lifting.	1. Ensure cranes and tools & tackles used for material handling are inspected and load tested by competent persons. 2. Check the slings before use for possible damages. 3. Use slings of correct capacity. 4. Keep persons at a distance while material is lifted/lowered. 5. Restrict entry of persons to work area by barricading/cordoningand caution signage
		b) Failure of cranes.	1. Ensure periodic load testing and certification of cranes and other material handling tools & tackles by competent person. 2. Use cranes of correct capacity. 3. Periodic maintenance of cranes.
		c) Fall of poles from truck.	1. Properly fasten the poles.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
2.	Transportation of poles	a) Fall of poles from truck.	1. Speed limit of approx 20 km/hr. shall be maintained. 2. Lock the movement of poles by proper fastening.
		b) Hitting of the projected poles.	1. Avoid projecting the poles beyond the truck platform. 2. Use truck trailors as far as possible. 3. Care shall be taken while turning. 4. Display red flag/lamp at the tail end of the projected portion of the pole if any.
3.	Excavation of pole pits	a) Fall of person in pits	1. Hard barricade and cordon the excavated pits with caution signage.
4.	Erection of poles	a) Injury due to slippage of poles.	1. While lifting up the pole, ensure proper anchorage. 2. Restrict entry of persons to work area by barricading/cordoningand caution signage
		b) Fall of pole due to slippage of person.	1. Ensure sufficient persons are deployed for the job.
		c) Fall of pole due to breakage of rope.	1. Use ropes of adequate capacity. 2. Check ropes for its healthiness.
		d) Fall of pole due to hitting of vehicle on the stay ropes	1. Caution boards indicating the stay ropes shall be put.
5.	Installation of light fittings	a) Fall of person from height.	1. Persons working at 2.5 m and above shall have valid heightpass. 2. Ensure the usage of full body harness and anchoring it to a firm structure. 3. Use self supporting ladders preferably A- Frame ladder of appropriate specification.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Fall of Tools/Material from height.	1. Ensure persons are not working below the working spot. 2. Restrict entry of persons to work area by barricading/cordoningand caution signage 3. Use safety net.

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JHA on Storage and Preservation of Electrical Equipment.

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Hammer, Nails, Sealing Gun Vacuum cleaner, Crow Bars, Spanners, Pressure regulator, Scissors, Containers for specified items.
4. PPE required : Safety Helmet, Safety shoes, Full body harness, BA sets, Hand gloves, Cotton Boiler suit.
5. Authorization Required : Height pass, scaffolding certification

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Opening of wooden boxes	a) Injury to hand	1. Leather gloves should be used. 2. Use safety Helmet and Cotton Boiler suit.
		b) Fall of person	1. Persons working at 2.5 m and above shall have valid heightpass. 2. Ensure the usage of full body harness and anchoring it to a firm structure. 3. Cover openings by using Safety Net. 4. Ensure supervision of job by a qualified experienced person.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Hitting of object	1. Ensure supervision of job by a qualified experienced person. 2. Establish communication with Crane Operator. 3. Skilled person should be deployed for entire work.
		d) Snake bite	1. Be vigilant about presence of snakes or insects in the package. 2. Display poster with actions to be taken in case of snake bite. 3. Transport the victim to the first-aid centre/hospital for prompt medical attention.
2.	Cutting of sealed package and inspection of equipment	a) Damage to sealed packet.	1. Seal of the package should be opened carefully. 2. Proper hand tools should be used. 3. Ensure required illumination at the work spot as per statutory requirements. 4. Use hand tools safely.
		b) Suffocation	1. Provide ventilation to the working area. 2. Keep BA set handy for use in case of necessity.
3.	Sealing of package and re packing of wooden boxes.	a) Fall of person	1. Persons working at 2.5 m and above shall have valid heightpass. 2. Scaffolding and platforms should be inspected and certified for use. 3. Safe platform should be provided at work approach

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Injury due to nails	1. Use boiler suit. 2. Use leather gloves, safety helmet. 3. Use nails and hammer of proper size.
		c) Damage in Hand	1. Person should concentrate on his work and distractions to be eliminated. 2. Ensure proper supervision of job. 3. Skilled person should bedeployed for the job. 4. No jacking should be done at the time of work.
		d) Fire hazard	1. Sealing gun should be handled carefully. 2. Temperature of sealing gun should be controlled. 3. Cleaning agent and preservatives should be removed from work area after completing work and maintain good housekeeping. 4. Fire extinguishers should be placed at material storage area.
		e) Electric shock.	1. Use 24 volt electric supply lamps, tools and machines. 2. Provide ELCB on electric supply board. 3. Supply cables and electrical equipment should not hit at time of work. 4. Ensure proper supervision on work.
4.	Unloading of acid cans form truck.	a) Fall of acid cans leading to leakage ofacid and resulting in inhalation of vapours and sever skin burns.	1. Use safety shoes, Rubber gloves and Boiler suit and apron. 2. Skilled man power should be deployed for job. 3. Ensure proper supervision of job.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Put cans on sturdy/stable stand. 5. Acid storage should be in separate area away from other materials in store.
		b) Suffocation due to acid fumes.	1. Area should be properly ventilated.
		c) Fire Hazard due to presence of hydrogen.	1. Maintain proper Ventilation. 2. Use special type tube light holder. 3. Use closed type MCB for switching on/off of lamps.
5.	Storage of transformer oil drums.	a) Slipping of drums and injury to person	1. Drums should be properly supported on ground. 2. All drums should be laid horizontal. 3. Cap of drums should be top side of drum. 4. Blocks should be used to prevent rolling of drums.
		a) Fire Hazard due to leakage of oil	1. Drums should be sealed properly and ensured to be leak free. 2. Leaky drums should be removed immediately and transferred to a safe area identified for thepurpose. Place a sticker indicating leaky drum. 3. Fire extinguisher should be used in case of potential fire situation.
6.	Storage of materials	a) Injury due to fall down of material at the time of searching some material.	1. All materials should be stored properly and its management should be effective. 2. List and mark the materials in field with location in storage. 3. Heavy and light weight material should be separated out at location.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Fire Hazard	1. Use fire extinguishers. 2. Separate storage should be provided for flammable materials. 3. Provide proper ventilation in store.

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JHA on Using of Construction Power extensions, using Portable Electrical Equipment and double insulated tools

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Line proximity tester, Screw driver, knifea
4. PPE required : Safety shoe, Face shield, Goggles, full body harness.
5. Authorization Required : Electrical authorization, height pass

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Extension of power supply	a) Electric shock from the supply cables.	1. The job should be performed by authorized persons for electrical works. 2. Use inspected and certified plug tops and extension boards. 3. Ensure ELCB is available and healthy. 4. Check leads (supply cable) for any damage. 5. If the cable has joints, ensure that the same is not kept in wet area. 6. Avoid routing the lead cables through the passages. 7. Ensure proper earthing.
2.	Using the machines	a) Electric shock	1. Use proper plug tops. 2. Ensure ELCB is available and healthy. 3. Ensure proper earthing of the machines.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Avoid using machines in wet condition. 5. Do not leave machines exposed to rain while not doing the work. 6. Ensure that the machines are not wet before using. 7. Ensure that the power supply panels are earthed. 8. Check the ELCBs periodically for healthiness. 9. Check the earth pits for its earth resistance value. 10. Check the earth connections periodically and ensure its connectivity.
		b) Shock by use of machines under repair / faulty.	1. Use identification tags/ stickers on machines indicating machines are healthy or under repair / faulty 2. Ensure guarantied isolation of works during maintenance. 3. Ensure periodic checking of machines and indicate due date of next checking on the machines
		c) Shock hazard due to damaged insulation for double insulated tools	1. Periodically examine the machines for possible damageson the double insulated body of the machines. 2. Ensure periodic checking of the machines and indicate the due date of the next checking on the machines.

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JHA on installation of temporary lighting during construction

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Ladder, scaffoldings, portable drilling machines, proximity tester
4. PPE required : Safety helmet, full body harness, safety shoe, Nose mask
5. Authorization Required : Height pass to performers, scaffolding certification, electrical authorization

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Assembly of scaffolding	a) Fall from height	1. The persons working at 2.5 m and above height should have valid height pass. 2. Scaffoldings and platforms should be certified for use by a competent engineer. 3. Choose a firm level area for scaffolding stand. 4. Wear full body harness, safety shoe and helmet. 5. While lifting of scaffolding, rope of good quality shall be used. 6. Check that the ladders have rungs at regular intervals. 7. Ensure outriggers ofscaffolding are properlyerected.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			8. Check the locking of scaffolding wheels. 9. Ensure easy access to the top by providing ladder/ scaffolding. 10. Ensure proper installation of cross bracings inadequate numbers for structural rigidity. 11. Provide safety net wherever openings are exposed.
2	Marking for circuit installation	a) Fall of person	1. The persons working at 2.5 m and above height should have valid height pass. 2. Scaffoldings and platforms should be certified for use by a competent engineer. 3. Ensure use of full body harness and its anchoring to a stable position.
		b) Slippage of the ladder	1. Ensure rubber stoppers for the ladder 2. Ensure that ladders are installed at about 75^{o} angle from horizontal. 3. Use of A-Frame ladder for required size is to be ensured.
		c) Toppling of Scaffolding	1 Ensure that ladders are installed at about 75^{o} angle from horizontal. 2 Ensure rubber stoppers for the ladder. 3 Ensure sufficient base widthof the scaffolding. 4 Scaffoldings and platforms should be certified for use by a competent engineer.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			5 Ensure sufficient base width of the scaffolding 6 Ensure persons are not on the scaffolding while the scaffolding is shifted
		d) Injury due to fall of material	1. Ensure use of safety helmets 2. Restrict personnel movement in the working area by barricading/cordoning and caution signage.
3	Drilling for fixing of wires	a) Fall due to improper balancing	1 Use self supporting ladders suck as A frame ladders. 2 Ensure proper width of working platform 3 Use full body harness and ensure its anchoring to stable structure.
		a) Electric shock	1. Ensure proper Earthing of the tools. 2. Ensure that ELCB is in the power circuit from where the power to the portable machines are drawn
		b) Injury to eye due to drilling dust	1. Ensure use of goggles and Nose mask.
4	Circuit installation	a) Electric Shock hazard	1 Ensure that the routing of the circuits for temporary lighting will not hinder material movement and cause damage to the circuits. 2 Ensure the joints are proper and the construction curing water will not cause shock hazards 3 Ensure the use of ELCB in the circuit and is functional.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
5	Installation of fittings	a) Slippage of the material	1. Use rope to lift the material 2. Ensure that persons are not standing below while lifting the material 3. Restrict entry of persons to work area by barricading/ cordoning and caution signage.
		b) Electric shock hazard	1 Ensure that the location of the light fittings for temporary lighting will not hinder material movement and cause damage 2 Select the location of the fittings so that the construction curing water will not cause shock hazard 3 Ensure the use of ELCB in the circuit and is functional.
6	Installation of Distribution boards	a) Electrical shock hazard	1 Ensure that the location of the Distribution boards for temporary lighting will not hinder material movementand cause damage 2 Select the location of the distribution boards so that the construction curing water will not cause shock hazard 3 Ensure proper Earthing of the distribution boards. 4 Ensure the use of ELCB in the circuit and is functional.

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JHA on Working under Transmission Line

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : As per job requirement
4. PPE required : Safety helmet, safety shoes, full body harness, Ear muff/plug, hand gloves (Insulation)
5. Authorization Required : Trained and qualified man power required.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all theworkers before commencement of the job by the Executing Engineer/Supervisor.		
1.	General	a) Risk of electrocution	1 Permit/clearances should be obtained to carry out any activity in vicinity of transmission line or even taking out the heavy material under the transmission line. 2 Induction voltage in the proposed area to be physically verified with assistance of electrical group. 3 The persons working at 2.5 m and above height should have valid height pass and should work on in sound platform with hand rail. 4 Full body harness should be used specific to the requirement. 5 Scaffoldings and platforms should be certified for use by a competent engineer.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			6 Ensure use of full body harness and its anchoring to a stable position. 7 All workmen should wear helmet, safety shoes and rubber hand gloves.
2.	Erection activity under the Transmission line	a) Risk of electrocution	1 Any erection work should not be permitted under the transmission line. 2 The minimum clearance as per voltage grade of Transmission line should be maintained. 3 Insulated Rubber hand gloves should be made a compulsorily to avoid any effect due to induced voltage. 4 Safety shoes and safety Helmet should be used compulsory. 5 All steel structure should be grounded. 6 Any height work or overhang object or lengthy object/ umbrella should be handled carefully and minimum clearance (Phase to Earth) should be ensured. 7 Stop the work during rainy season or during stormy weather
3.	Erection work near transmission line	a) Risk of electrocution	1 Any activity near the Transmission line must be carefully taken up. 2 Structure and work area shouldbe segregated keeping in mind the minimum clearance desiredand safety of personnel.

			3 All steel structures should be grounded and intactness of grounding system should be checked regularly.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4 Use of electrical safety shoes, gloves should be ensured.
4.	Shifting of material underneath of transmission line.	a) Risk from electrocution	1 Minimum clearance from line to earth should be ensured. 2 Use of PPEs by workers to be ensured. 3 Illumination to be ensured in work area as per statutory requirements.

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JHA on Erection of Construction Power Supply

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Megger, multi meter, tong tester, continuity tester and proximity tester.
4. PPE required : Helmet, Safety shoes, Safety Helmet, full body harness.
5. Authorization Required : Qualified and authorized electrician.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Construction power supply panel, selection	a) Fire hazard due to use of ICTPN switches.	1 Switches should not be used in ICTPN switch construction power service. 2 Earth Leakage Circuit Breaker should be used on distribution network. 3 MCCB should be used as in- comer in place of switch fuse unit. 4 Re-wirable fuse should be avoided for construction power supply network. 5 HRC fuse should always be used.
		b) Fire hazard due improper selection of switches and fuse.	1 Switch capacity should be adequate to withstand the fault condition. 2 Fuse selection should be coordinated as per requirement. 3 Fuse and overload relay should be coordinated in such a way that risk of fire is minimized.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Earthing terminal should be provided for panel earthing andall metallic parts of the components of the panel should be connected to Earthing bus/grounded.
2.	Installation of Power supply Cables, lying of Welding Cables.	a) Hazard due to non proper, laying and tying of power cable and welding cable.	1 Power cable should always be laid in race ways/trays/on wall/ceiling, in conduit and pipe only. 2 No length of power cable should be in Air. 3 Welding cable also, should be laid in proper raceway/trays/on steel supports/on bracket.
		b) Fire hazard due to heating up of joints on welding cables.	1 Welding cables should be joint less and if any joints are to be made the same is to be crimped and insulated properly. 2 Heat resistance insulation tap should be applied on all welding cable joints. 3 Proper housekeeping should be maintained, around the welding machine and welding cable and at the job location. The location should be free from combustible material, oil and grease.
3.	Installation operation and maintenance of Power supply panel.	a) Risk of electrical shock during operation and maintenance of panel.	1 Rubber mat should be provided in front of all electrical panel. 2 Panels should be grounded with two nos. of distinctive grounding pads/elect rods. 3 Two point Earthing of panel should be ensured. 4 All panels, doors should be closed and should be as per requirement of degree of protection for the area.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			5 Appropriate fire extinguishersand fire safety measures such as sand bucket should be providednear the panel. 6 Danger sign board/sticker should be provided on the panel. 7 Identification of panel and feeders should be clearly indicated. 8 Authorized electrician should only be permitted for the operation and maintenance of panel. 9 Work permit system should be evolved for carrying out the maintenance work on construction power supply network/system. 10 Earth resistance of Earthing pit/electrodes/grounding system should as per applicable codes and standards. 11 Power supply connection should only be permitted aftercompliance with all safety norms such earth system, use of ELCB. Coordination of switch, fuse and relay should be ensured.

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JHA on Use of Electrical Testing Instruments

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Megger, High Voltage Test Circuit, Multi Meter Transform Ratio Tester, Relay Testing Circuit, Variac BDV Tester, Over Load Relay Testing Kit, Proximity Tester
4. PPE required : Rubber mat, Grounding load, Insulated Clamps, safety shoes, full body harness.
5. Authorization Required : Skilled man power, Work Permit from control room, height pass, scaffolding certification.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Transformer oil BDV Testing	a) Electric shock due to high voltage.	1 Rubber mat should be used at time of BDV Testing. 2 High voltage Rubber gloves should be used. 3 Gradually voltage should be increased.
		b) Flashover in oil	1 See that testing circuit pot is kept on stable place. 2 Visually check the Transformer oil for taking care of spark. 3 Check main switch healthiness before use.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4 Check healthiness of cable before use.
2.	Transformation ratio testing job.	a) Electric shock to person.	1 Check IR Value of winding (>10 Mega Ohms. 2 Ground the terminal after meggering. 3 Area barricading to be ensured. 4 Check healthiness of power supply switch, Ratio Transfer supply cable. 5 At the time of changing clamp connection, first discharge the potential then only open/connect the clamp.
		b) Flash over	1 Change top only after switching off the main switch. 2 Healthiness of Ratio circuit should be checked before use.
2.	High voltage test of power cable	a) Electric shock to person.	1 Ensure identification of cable used for high voltage test. 2 Check IR values of cable and ensure the same to be healthy. 3 Working area to be cordoned at both ends of cable. 4 Check healthiness of circuit, main switch, supply cable etc. 5 Use prescribed voltage for each cable in high voltage test.
3.	IR. Checks on electric equipment	a) Electric shock to person	1. Proper identification of electrical equipment, power cable, power bus, Motor and lighting panel should be done before starting IR value checks. 2. Discharging of circuit should be done from long distance by grounding lead.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Ensure that nobody touches the Megger circuit. 4. Use Insulated clamps. 5. Use Rubber hand gloves for putting clamp. 6. First connect ground point of Megger. 7. Discharge equipment after meggering by flexible grounding lead.
		b) Flash over in Megger.	1. Check healthiness of Megger before use. 2. Check connection supply circuit of Megger.
4.	Relay testing job.	a) Electric shock to persons	1. Check any loose connection. 2. Check and ensure healthiness of Power Supply, cable ON/OFF switch. 3. Check and ensure healthiness of testing circuit should be checked before use. 4. Check IR & WR of Relay coil, which are going to be tested. 5. At the time of Testing personshould not touch Relay terminals.
		b) Injury due to flash over.	1. Check and ensure healthiness of coil of relay. 2. Before use, check voltage of Relay for testing. Prescribed voltage is to be used for testing. 3. Check healthiness of testing circuit. 4. Use Rubber mat and Rubber hand gloves.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
5.	Overload relay testing	a) Electric shock to person.	1. Check healthiness of supply cable, ON/OFF switch and connection leads. 2. Check IR value of overload Relay. 3. Use current in Relay as per prescribed characteristic graph between Time and Current.
		b) Flashover in relay	1. Arrange proper cooling of over load relay at the time of test. 2. Take care of injected current time for relay characteristic graph. 3. Check healthiness of testing kit should be checked before use.
6.	Primary injection of current in CT circuit	a) Electric shock.	1. Check circuit healthiness, Relay healthiness before starting test. 2. Check for healthiness of supply injection kit connection circuit.
		b) Flash over in wiring	1. Check for any loose connection. 2. Check for IR value of circuit. 3. Connected circuit should be isolated from other circuit.
7.	Use of multi meter for checking voltage winding resistance	a) Flash over in multi meter during checking.	1. Ensure healthiness of multi meter and its leads before use. 2. Maintain proper distance from high voltage end at time of voltage measuring. 3. Stand on rubber mat at time of testing. 4. Check proper selection of multi meter at the time of testing voltage, Select in voltage range, If the meter is in resistance range, flash over will take place.

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JHA on Erection of Diesel Generating Set and Auxiliaries

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Multi axle trailer, Mobile Cranes slings, chain pulley block, scaffolding, electrical instruments, megger, tong tester, proximity tester, tachometer
4. PPE required : Safety helmet, Safety shoe, Face shield, Goggles, fall arrestor, Full body harness, apron, gloves
5. Authorization Required : Scaffolding certification, height pass, electrical authorization, HSD storage certification, CEA electrical inspector clearance, clearance for stack(chimney) and pollution control board, approved procedure for commissioning

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Loading on trailer	a) Failure of sling	1. Periodic examination of slings by competent person 2. Use slings of correct capacity 3. Keep persons at a distance whilethe material is being lifted. 4. Restrict entry of persons to work area by barricading/cordoning and caution signage.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Failure of Cranes	1. Ensure periodic load testing of cranes by competent person. 2. Use cranes of adequate /appropriate capacity. 3. Conduct periodic maintenance of cranes.
		c) Overturning of the cranes.	1. Ensure the boom length and angle corresponds to the load being lifted. 2. Ensure the counter weights are sufficient.
		d) Slippage from Trailer	1. Ensure the level of the Trailer to be sufficiently horizontal. 2. Use stoppers to arrest the movement. 3. Fasten the crane after placement.
2.	Transportation	a) Slippage of the material from Trailer	1. Ensure the quality of rope used to fasten. 2. For multi axle trailer speed shall be limited to 5 km/hr.
		b) Tilting/Over turning	1. Survey the roads and ensure thatthe roads are leveled before movement. 2. Ensure that the back-filled /newly formed roads are properly compacted. 3. Avoid road with too much of gradient.
		c) Breakage of fastening ropes.	1. Ensure the quality of rope used to fasten. 2. Use steel rope for heavy cargo 3. Check for any damages of the rope

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
3.	Unloading	a) Failure of slings	1. Ensure periodic examination of slings by the competent persons. 2. Use slings of correct capacity 3. Keep persons at a distance whilethe material is being lifted 4. Restrict entry of persons to work area by barricading/cordoning and caution signage.
		b) Over turning of the material	1. Ensure the material is unloaded ona leveled area. 2. The wooden sleepers used shouldbe of sufficient capacity to take the load. 3. Ensure the area is properly compacted.
4.	Shifting / loading of the DG to the erection spot.	a) Slippage of material	1. Ensure the area is leveled and compacted before placement of the loading rails. 2. Check the horizontality of the rails. 3. Ensure the usage of stoppers to arrest the excess movement. 4. Ensure the usage of rope/chain pulley block and anchors.
5.	Alignment of the diesel generator	a) Failure of lifting hydraulic jacks.	1. Ensure the usage of sleepers below to arrest the sudden down ward movement. 2. Use correct capacity of Hydraulic jacks. 3. Use correctly pressure rated hoses.
6.	Auxiliary equipment erection	a) Failure of chain pulley blocks	1. Use the correct capacity chain Pulley blocks 2. Ensure load testing of the Chain Pulley block. 3. Ensure periodic maintenance of the chain pulley block.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Failure of Anchoring points.	1. Check the anchorage points for its load bearing capacity. 2. If designated anchoring points are not available; select anchoringpoints in consultation with the building designer to avoid failure of columns/slabs.
7.	Filling of diesel	a) Fire hazard	1. Ensure fire alarm system is operational 2. Ensure fire extinguisher system is operational. 3. Prohibit smoking. 4. Ensure housekeeping. 5. Ensure earthing and bonding of diesel tanks and pipelines as protection against static charge
8.	Commissioning	a) Fire hazard due to electrical faults.	1. Ensure protection circuits are checked as per the checklist. 2. Ensure the protection circuits are healthy and operational.
		b) Electric shock due to energization of motor / generator	1. Electrical checks to be carried out by authorized person.
		c) Chemical burns during flushing of pipelines	1. Use PPEs for protection against chemical spillage. 2. Ensure portable eye washer is available

JHA on Erection of Diesel Generating set and Auxiliaries	Rev. No.	Doc. No:	Page 4 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Energization/Integrated Commissioning of Electrical System.

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Rubber mats, proximity tester, megger
4. PPE required : Insulated hand gloves
5. Authorization Required : Electrical authorization, height pass

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Identifying the activity schedule.	a) Risk of ignoring the important activity which is compulsory pre-activity for safety of the system	1. All pre activity to a particular system should be noted which shall be compulsory for energisation of system. 2. Detailed schedule should be made and endorsed by senior experienced Engineer.. 3. Comprehensive network should be made indicating all pre activities should be indicated and same to be approved.
2.	Energisation of switch yard	a) Risk of flashover	1. Minimum clearance (Phase to phase and phase to earth) for line and buses to be ensured. 2. Two point earthing of the system and equipment to be ensured. 3. Minimum step potential andtouch potential norms to be complied and gravel to be used.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Gravels should not have sharp edges. 5. Energisation should not be done in rainy and foggy weather condition. 6. Illumination should be providedas per statutory guidelines. 7. Good housekeeping should be ensured.
3.	Energisation of Transformer	a) Risk of fire at the time of charging of Transformer.	1. Mulsifire system should be operational at the time of changing of Transformer. In case same is not available then Fire tender should be deployed near transformer along with sufficient number of Fire Extinguishers and fire handling trained personnel to meet any emergency. 2. Oil soak pit, burn oil pit and drainage system must exists and should be free from any foreign particles. 3. PRV/RPD should exists for all oil filled Transformers. 4. Adequate and appropriate type of fire extinguishers should be provided in the room of dry type transformer. 5. Successful primary injection test should be performed as a pre-requisite for the energisation of Transformers. 6. At the time of final energisation the LV side breaker should be opened and transformer should be kept under observation for period of minimum 24 hours beforeloading of transformers.

JHA on Systematic Approachto Energization / Integrated Commissioning of Electrical Systems	Rev. No.	Doc. No:	Page 2 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			7. All protection systems should be available. 8. All communication systems should be functional. 9. All the pre-commissioning / commissioning tests should have been completed. 10. DC system should have been completed. 11. Ensure illumination as per statutory requirements. 12. Ensure good housekeeping. 13. Fire protection system and fire water system should be available /commissioned /operational.
4.	Energisation of switch gear panels	a) Risk of short circuit and eventual fire risk	1. Before energisation of SWGRs/ electrical panel, the power circuit must be subjected to high voltage test and after successful HV test only, electrical panel should be charged. 2. All Pre-commissioning and commissioning tests should be successfully completed before energisation. 3. Adequate and appropriate fire extinguisher should be available before energisation. 4. DC control/protection powersupply system should beoperational. 5. All protection to the equipment/ system should be available. 6. Ensure illumination as per statutory requirements. 7. Ensure good housekeeping.

JHA on Systematic Approachto Energization / Integrated Commissioning of Electrical Systems	Rev. No.	Doc. No:	Page 3 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
5	Operation and maintenance activities on charged electrical system.	a) Risk of electrocution.	1. Work permit system should be available and used. 2. Qualified and authorized person only should be permitted for operation and maintenance activities. 3. Electrical gloves and helmet should be used. 4. Ensure illumination as per statutory requirements. 5. Ensure good housekeeping. 6. Proper tagging, identification and caution should be provided to prevent any wrong identification of equipment. 7. First-aid chart on electrocution should be provided along with chart which shall be helpful for understanding the First-aid system. 8. Minimum clearance (phase to earth/ground) should be ensured. 9. Bus bar should be earthed/ground before taking up to maintenance work. 10. Proper isolation of charged line system should be ensured before taking up any maintenance work. 11. Any isolation on safety related systems such as DC system must be thoroughly studied and redundant systems should comein force.

JHA on Systematic Approachto Energization / Integrated Commissioning of Electrical Systems	Rev. No.	Doc. No:	Page 4 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection of the Cable Metallic Structures

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Mobile cranes, Grinding machines, Welding machines, Power hacksaw, Gas cutting torch
4. PPE required : Safety helmet, hand gloves, Safety shoe, safety net. Full body harness, fall arrestor and life line
5. Authorization Required : Height pass. Scaffolding certification

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Loading and Unloading of structural steel on truck.	a) Failure of slings.	1. Periodic examination of the slings by competent person. 2. Use slings of correct capacity. 3. Keep persons at a distance while the material is lifted/lowered. 4. Restrict entry of persons to work area by barricading/cordoning and caution signage.
		b) Failure of the cranes.	1. Ensure periodic load testing of Cranes by competent person. 2. Use Cranes of correct capacity. 3. Periodic maintenance and testing of cranes to be undertaken.
		c) Fall of steel sections from the truck.	1. Properly fasten the material to the truck. 2. Carefully stack the material to avoid slipping.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Limit the persons coming near the work area. 4. Restrict entry of persons to work area by barricading/cordoning and caution signage.
2.	Transportation of the structural steel.	a) Fall of steel sections to the ground.	1. Properly fasten the material to the truck. 2. Speed limit of approx. 20 km/hr shall be maintained. 3. Arrest movement of material by fastening, by way of wooden stoppers /slippers.
		b) Hitting by projected sections.	1. Avoid projecting of the material outside the truck platform 2. Take precautions while negotiating curves. 3. For transporting long sections use long Trailer. 4. Display red flag/lamp at the end of the material.
		c) Over turning of the vehicle.	1. Use vehicle of adequate/ appropriate capacity. 2. Avoid over loading. 3. Negotiate curves at reduced speed
3	Gas cutting for fabrication	a) Burns from heated metal	1. Ensure that the metal is sufficiently cooled before handling. 2. Use asbestos hand gloves
		b) Fire hazard	1. Take hot work permit. 2. Ensure good housekeeping and see that combustible materials are not kept near by 3. Check hose connections of the gas cylinders are leak proof and are firmly secured with clamps. 4. Check the hoses for its quality

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			5. Ensure that the hoses are not kept in the path of material handling 6. Ensure the availability of the fire extinguishers nearby.
4	Cutting using power hacksaw	a) Injury from rotating / moving parts.	1. Ensure that the persons are far away from the rotating / moving parts 2. Ensure guards are fixed to avoid accidental touching of the rotating parts.
		b) Electrical shock hazard	1. Ensure that the Machines are earthed. 2. Ensure that ELCB is in the circuit and is healthy.
5	Welding	a) Burns from hot metal	1. Ensure that the metal is sufficiently cooled before handling. 2. Use Asbestos Hand gloves
		b) Burns from weld splinters	1. Ensure that the weld splinters are contained by way of keeping Asbestos sheets. 2. Restrict entry of persons to work area by barricading/cordoning and caution signage.
		c) Fire hazard	1. Take hot work permit. 2. Ensure good House Keeping and ensure combustible materials are not kept nearby. 3. Ensure that the weld splinters are contained by way of keeping Asbestos sheets. 4. Ensure the availability of the Fire extinguishers.

JHA on Erection of Cable Metallic Structures	Rev. No.	Doc. No:	Page 3 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
6	Marking for erection	a) Fall of person	1. Persons working at 2.5 m and above shall have valid height pass. 2. Rubber mat should be available near supply panels. 3. Use full body harnesses and fall arrestors. 4. Ensure Rubber stoppers for the ladder 5. Ensure sufficient base width of the scaffolding 6. Ensure the working platform is stable and certified
		b) Slippage of the ladder	1. Ensure angle of inclination of about 75^{o} for the ladder 2. Ensure Rubber stoppers for the ladder.
		c) Toppling of scaffolding	1. Ensure sufficient base width of the scaffolding 2. Ensure persons are not on the scaffolding while the scaffoldingis shifted.
		d) Injury due to fall of material	1. Use safety helmets 2. Restrict entry of persons to work area by barricading/cordoning and caution signage.
7	Erection of the tray supports / cable trays	a) Slippage of the material	1. Use rope to lift the material 2. Provide safety net. 3. Ensure that persons are not standing below while lifting the material

JHA on Erection of Cable Metallic Structures	Rev. No.	Doc. No:	Page 4 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Installation of Earthing & Lightning Protection Equipment

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Shuttering material, Earthing strip / Conductor, suspended platform, Hammer, Spanner set, Horizontal & Vertical termination mast test link, saddles and spacers.
4. PPE required : Safety Helmet, Hand gloves, Goggles, full bodyharness, Manilla rope, Boiler suit, suspended platform.
5. Authorization Required : Permission from civil in charge for work, height pass

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Loading/unloading & transportation of shuttering materialand steel rod.	a) Hit injury and cut injury due to fall of material.	1. All the material should be kept inside the Tractor trolley safely. 2. Over hanging should not be allowed. 3. Special care should be taken during loading and unloading of material.
2.	Installation of saddles	a) Fall of person, fall of material.	1. Necessary PPE like helmet, full body harness should be used. 2. Handle tools should be used carefully. 3. No other activity should be carried out under this work.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
3.	Shifting of shuttering material and earthing material	a) Fall of person, fall of material and shearing of rope	1. Safety helmet, safety shoes and full body harness with anchoring should be used. 2. Ladder hand rails should be available up to the approach of work spot. 3. Safe working platform and walk ways with double mat should be provided. 4. Scaffolding and working platform should be inspected certified. 5. Landing mat should be tied to scaffolding and safety net should be provided below the platform. 6. Workers with valid Height pass only should be allowed to work at height. 7. Good quality and sufficient capacity manila rope should be used. 8. Chain pulley block should be tested and inspected before use. 9. The side of the material being taken up should be tied properly.
4.	Placing of saddles in walls	a) Fall of material and fall of person.	1. Take care when drilling on walls. 2. Proper back support should be used by Machine operator. 3. Area should be cordoned off for ensuring protection from fall of scrap material. 4. Person should be very careful at the time of putting saddles in walls.
		b) Electric shock	1. Check healthiness of Machine. 2. Check IR value of supply cable for any physical damage for cable.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Ensure healthiness of supply switch. 4. Rubber mat should be available near supply panels.
5.	Use of suspended platform for work	a) Fall of platform and injury to person	1. Check healthiness of rope /sling /wire used for suspended platform. 2. Check healthiness of platform. 3. Check healthiness of crane hook, bracket support for hanging suspended platform. 4. Check healthiness of chain pulley block used for this.
6.	Welding of earthing strip	a) Burn injury in hand	1. Use hand gloves at time of welding of earthing strips.
		b) Eye injury due to welding light.	1. Use welding protection glass and helmet. 2. Fitter should be fix the strip carefully.
		c) Electric shock	1. Check healthiness of supply cable, welding machine, main switch and machine regulator. 2. Earthing should be provided from two separate points for welding machines and supply panel.
		d) Fire hazard.	1. Area cordoning to be done. 2. Flammable material should be removed from work spot. 3. Fire extinguisher should be ensured to be available in the area.
7.	Installation of horizontal and vertical air termination and lightening mast	a) Unbalancing of mast	1. Provide proper support for mast. 2. When working at height extra care should be taken for wind pressure. 3. Support for mast should be tied with proper sway up to pouring of concrete.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
8.	Construction of earth pit 3 meter depth	a) Fall down of person in earth pit.	1. Area should be condoned. 2. Railing should be provided around the pit. 3. Ladder should be used for entering earth pit. 4. Caution tag should be provided.
		b) Slipping of ladder at the time of entering and coming out from pit.	1. Ladder should clamped at top and tied from bottom side.
9.	Preparation of Earthing pit	a) Electric shocks to person if conductivity is to be maintained at the time ofpreparation.	1. Proper selection of area should be done. 2. Ratio of charcoal, salt, soil should be as per requirement. 3. Conductivity should be proper for soil

JHA on Installation of Earthing & Lighting Protection System	Rev. No.	Doc. No:	Page 4 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Erection of Cabling/Cable trays/Cable Supports Inside Tunnels

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Welding machines, drilling machines, grinders, oxygen meter , scaffolding platform, ventilation fan etc.
4. PPE required : Safety helmet, Safety shoe, Portable emergency light, face shield, goggles, full body harness
5. Authorization Required : Work permit, height pass, certification of scaffoldings

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Marking for installation of Cable support.	a) Hitting against the objects	1. Take permit for entry to confined area. 2. The area shall be illuminated sufficiently as per statutory requirements to notice the installed equipment hanging in ceiling / on the walls / on the floor. 3. Ensure the use of safety shoe and helmet. 4. Install soft cushion pad and apply glow in dark stickers/ paint on supports at lower elevation. 5. Ensure that portableemergency lights/torchesalong with spare cells areavailable 6. Ensure area housekeeping.

JHA on Erection of Cabling/Cable Trays/Cable Supports Inside	Rev. No	Doc. No:	Page 1 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		b) Reptile bites	1. Ensure illumination as per statutory requirements. 2. Carefully search for reptiles before the start of work.
		c) Suffocation.	1. Take Ensure that air circulation / ventilation system is started before starting the work. 2. Ensure that no foul smellarising out of stagnant air is felt. 3. Use Breathing Apparatus set.
		d) Shock hazards from the equipment used	1. Ensure that the equipment is properly earthed and power supply cord is having Earthing cord. 2. Ensure continuity of Earthing cord. 3. If Earthing is not available ensure that portable Machines being used are double insulated. 4. Ensure that the ELCB is in the circuit and is functional. 5. Extension boards shall be inspected and certified.
		e) Shock hazard from the temporary lighting / service cables	1. Ensure the temporary lighting / service cables are not having external damages, exposed / improper joints 2. Ensure that the temporary lighting circuits/power supply lines are not kept in the passage as same are prone to damage due to material movement.

JHA on Erection of Cabling/Cable Trays/Cable Supports Inside	Rev. No	Doc. No:	Page 2 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Avoid criss-cross hanging of the lighting cables. 4. The temporary service cables shall be properly dressed. 5. Ensure that ELCB is installed of in the lighting circuits and is functional.
2.	Cable support installation welding	a) Suffocation from weld fumes.	1. Ensure air circulation/ ventilation system is `ON' while working.
		b) Burns from weld splinters.	1. Ensure that the weld splinters are contained by way of keeping fire resistant cloths. 2. Restrict entry of persons in the working area by cordoning/barricading
		c) Burns from hot metal.	1. Ensure that the metal is sufficiently cooled before handling. 2. Use heat resistant hand gloves.
3.	Shifting of cable trays/installation	a) Injury due to material handling.	1. Ensure sufficient illumination as per statutory requirements to avoid hitting against installed equipment. 2. Ensure use of Safety Helmet. 3. Ensure use of Leather/Canvas Hand gloves.
		b) Entry/approach hazards.	1. Entry points should be sufficiently illuminated as per statutory requirements. 2. Use approach ladders like A-Frame ladders or erect certified scaffolding. 3. Ensure that no materials are stored near the entry points which may hinder the movement.

JHA on Erection of Cabling/Cable Trays/Cable Supports Inside	Rev. No	Doc. No:	Page 3 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
4.	Cable laying	a) Injury while cable handling	1. Sufficient persons should be deployed on the job. 2. Use hand gloves. 3. Ensure use of safety shoe.

JHA on Erection of Cabling/Cable Trays/Cable Supports Inside	Rev. No	Doc. No:	Page 4 of 4	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Installation and Commissioning of Motors, Motorized Valves and Heaters

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Megger, multi meter, tong tester, motor checker, capacitance and tan Delta kit, techo meter, Proximity tester, Scaffolding platform.
4. PPE required : Safety shoes, Helmet, Full body harness, Insulated hand gloves, Goggles.
5. Authorization Required : Work Permit, Qualified, experienced, trained and authorized Electricians and Supervisors are required, Height pass, Scaffolding certification

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Pre-commissioning and commissioning checks on motors, Motorized Valves (MV_s) and Heater.	a) Risk of falling of person from height	1. Persons working at 2.5 m andabove height shall have valid heightpass. 2. Scaffolding and platforms hall be inspected and certified for use. 3. Full body harness, helmet and safety shoe should be compulsorily used. 4. All ladders, scaffolding or platform should be securely/firmly tightened and braced. 5. Rubber hand gloves should be used while working on charged equipment 6. Structure/Equipment should have earthing/grounding.

JHA on Installation and Commissioning of Motor Fan, Motorised Valves and Heaters.	Rev. No.	Doc. No:	Page 1 of 3	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
2.	No load test run of Motor	Risk of fire due to no load run of faulty equipment motor/heaters.	1. IR valve of the motor/heater should be acceptable. 2. Inductance and capacitance for all three phases of motor should be balanced. 3. Resistance of the motors/heater should be as per specification. 4. No load test should be done on the identified equipment only and identification should be checked at source and load as well as control panel metallic enclosure of electrical source and load should be earthed/ grounded from two distinctive pads, at two points. 5. All pre-commissioning checks should be completed before the load run/test and result should be satisfactory. 6. Proper illumination as per statutory requirements shall be maintained. 7. Good housekeeping should be ensured in the area. 8. Capacitance and tan delta measurement should be done on all HT motors and comparison should be done with previous records.
3.	Load run of motors and heater.	a) Fire due to moisture ingress at the time of load run of motor and heater.	1. Direct water spray by any means should be avoided near the equipment 2. Water logging in the area should be avoided. 3. IR measurement should be done prior to running / charging of equipment/motors/heater.

JHA on Installation and Commissioning of Motor Fan, Motorised Valves and Heaters.	Rev. No.	Doc. No:	Page 2 of 3	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. Alignment of motor and greasing of bearing should be checked each time before run of motors. 5. Free movement of shaft of motorand sound free fan movement must be ensured. 6. Proper illumination as per statutory requirements and good housekeeping in the area needs to be ensured. 7. All fire protection measures should be ensured and fire protection system commissioning should be in operation.
		b) Risk of personnel injury at the timeof measurement of speed / doing observation.	1. All bolts of enclosures and coupling must be tightened. 2. Care must be taken not to physically touch the shaft while taking measurements. 3. Ensure that coupling guard, shaft guard and motor fan cover are available. 4. Goggles should be used for taking up the reading of tachometer if it has to be done on continuous basis.
		c) Risk of fire due to sparking and rise of temperature of bearing and insulation.	1. All fire protection system such as fire alarm system, fire water systemand portable fore fire extinguishers should be available. 2. Continuous observation and monitoring should be ensured for safe running of equipment. 3. RTD and BTD readings should be continuously monitored.

JHA on Installation and Commissioning of Motor Fan, Motorised Valves and Heaters.	Rev. No.	Doc. No:	Page 3 of 3	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Operation and Maintenance of Compressors, Motors and Ventilation Fans (Rotary Equipment)

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Scaffolding, planks, box spanners, sets, mobile cranes, chain pulley, block, sling, D-shackles, Nylon ropes, megger, tong tester, proximity tester, tachometer, vibration-meter
4. PPE required : Safety shoes, Leather hand gloves, Full body harness and Safety helmet.
5. Authorization Required : Crane operator training and qualification, Height pass, Electrical authorization

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Loading and unloading of equipment with crane	a) Fall of material due to breaking of D-shackle sling and pulley.	1. Ensure inspection and testing of all the slings, D-shackle by competent persons before its use as per manufacture's instruction and/or NTPL guidelines. 2. Restrict entry the area by barricading / cordoning and caution signage.
		b) Crane failure	1. Ensure inspection and testing of cranes by competent persons before its use as per manufacture's instruction and/or NTPL guidelines. 2. Never lift the load above rated capacity.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Restrict entry the area by barricading / cordoning and caution signage.
		c) Injury to person due to fall of material.	1. Ensure inspection and testing of material handling equipment by competent persons before its use as per manufacture's instruction and/or NTPL guidelines. 2. Never lift the load above rated capacity. 3. Restrict entry the area by barricading / cordoning and caution signage.
		d) Injury due to caught in between the objects.	1. Wear Leather hand gloves.
2.	Removing of sling, D-shackle	a) Injury to finger or hand	1. Remove sling / D-shackle carefully. 2. Use leather hand gloves and helmet.
3.	Preparation of scaffolding for installation of fan	a) Injury due to fall of scaffolding part at the time of preparation	1. Ensure inspection and certification of scaffolding and platform for use. 2. Tie scaffolding with manila Rope for lifting. 3. Hook the chain block properly. 4. Establish effective communication between thecrew members.
		b) Fall of person from height.	1. Persons working at 2.5 m and above shall have valid height pass. 2. Deploy skilled persons for the job.

JHA on Operation Maintenance of Compressor, Motors, Ventilation fans (Rotary equipment)	Rev. No.	Doc. No:	Page 2 of 5	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Ensure proper supervision of job. 4. Use full body harness and safety helmet.
4.	Installation of ventilation fan in wall	a) Fall of material and spanners	1. Area cordoning should be done. 2. All tools, loose material nuts, bolts should be put in the bag. 3. Spanners should be tied with thread at the time of use. 4. Before leaving, install the fan and tie the nut bolt of foundation.
5.	Crimping of power cable lug and connection of cable	a) Injury in hand at time of peeling of cable.	1. Use sharp edge knife. 2. Use hand gloves. 3. Deploy experienced person. 4. Direction of movement of knife should be away from body.
		b) Injury of hand at the time of crimping job.	1. Use tested crimping tools. 2. Use hand gloves. 3. Skilled person should be deployed for job. 4. Use proper size of die for different cable. 5. Remove your hand from crimping area of lug. 6. After crimping, discharge hydraulic pressure then only shift the lug position.
		c) Hand injured at time of tightening the power cable ontermination.	1. Skilled person should deployed. 2. Use proper torque by hand for tightening of terminal bolts.

JHA on Operation Maintenance of Compressor, Motors, Ventilation fans (Rotary equipment)	Rev. No.	Doc. No:	Page 3 of 5	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		d) Injury in hand due to burs.	1. Remove burs after crimping the lug.
6.	Commissioning of Compressor Motor	a) Electrical shock at time of checking of IR valve	1. Persons authorized for electrical works only perform job. 2. Ensure proper identification of power cable. 3. Discharge the cable before and after checking IR Value. 4. Main breaker should be kept off, tagged and isolated.
		b) Electrical shock during logic checks.	1. Persons authorized for electrical works only perform job. 2. Switch off the control supply used in the circuit. 3. Before checking IR values of circuit, check whether the wirings are as per drawings. 4. Charge the control circuit only after complete checking of above mentioned items.
		c) Accident due to rotating machines.	1. Check guards are provided on compressor pulley, motor pulley, shafts and belts. 2. Free movement should be checked for motor and compressors. 3. Before starting the motor first time, ensure that persons are not near equipment. 4. Check that all protections are available before charging the circuit.

JHA on Operation Maintenance of Compressor, Motors, Ventilation fans (Rotary equipment)	Rev. No.	Doc. No:	Page 4 of 5	Sign. of agency	Sign. Of NTPL EXECUTIVE

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
7.	Load testing of Compressor	a) Accident due to loose foundation bolt	1. Foundation bolt should be checked to be tight. 2. First start of the motor should be momentarily only.
		b) Flash over in electrical circuit.	1. Persons authorized for electrical works only perform job. 2. Check IR value before use. 3. Protections are checked to be available. 4. No loose connection should be in power cable as well as control circuit.
		c) Fire hazard	1. Fire extinguishers should be available in the nearby location. 2. Skilled person should be deployed for the work. 3. Inform Control Room & take permission from Control room.

JHA on Operation Maintenance of Compressor, Motors, Ventilation fans (Rotary equipment)	Rev. No.	Doc. No:	Page 5 of 5	Sign. of agency	Sign. Of NTPL EXECUTIVE

JHA on Maintenance on Switchyard while other BUS is charged.

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Scaffolding, Fiber made step stool, fiber made ladder, Grounding rod, Grounding leads spanner set, spares cleaning agent marking cloth.
4. PPE required : Full body harness, Boiler suit, Safety shoes, insulated gloves
5. Authorization Required : Work Permit from control room, Height pass for workers, overhead working line pass., Electrical authorization

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Isolation of Bus	a) Flash over at the time of isolation.	1. The persons should have authorization for working in electrical systems. 2. Make sure that breakers are in `OFF' position and then open isolators and lock them. 3. Check that all three Breaker phases are open.
2.	Grounding of Bus Bar	a) Electrical shock due to falling down of grounding rod on charged bus.	1. Clamp the grounding lead to grounding rod/earth switch 2. Clamp should be tight with lead.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			3. Deploy experienced and skilled person for the job. 4. Ensure supervision. 5. First connect lead on grounding point and then put bus for grounding.
3.	Preparation of scaffolding for bus maintenance	a) Electrical shock due to Induction voltage	1. Scaffolding should be grounded. 2. Every scaffolding step taken on height for putting over should be taken with grounding lead.
		b) Flash over due to fall down of scaffolding.	1. Scaffolding should be inspected and certified. 2. Scaffolding should be properly tied with fixed tower support to prevent fall due to wind pressure. 3. Loose material like Tarpoline, if any should be tied with fixed support.
4.	Opening of Bus-Bar joint	a) At the time of opening the conductor of Bus Bar, it may fall down on live bus causing flashover.	1. Before loosening clamp, it should be tied with a rope. 2. After opening the tie, fix the supports and take up further activity.
5.	Maintenance on BUS BAR	a) Fall of material and spanners	1. Put spanners in box. 2. Tie tools with thread.
		b) Fall of person	1. Continuous supervision on the job to be done. 2. The persons working at 2.5 mand above height shall have valid height pass. 3. Deploy skilled manpower for work.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Flash over due to unwanted operation of breakers and isolator.	1. Discharge operating energy of mechanism. 2. Put mechanical lock for operation of isolators.
			3. Check proper grounding of both ends of line.
6.	Transportation of material in switch yard.	a) Electrical shock due to transport material in Switch yard.	1. Carry the material like scaffolding, ladder and other material down at shoulder height. 2. Use shoulder pad. 3. Use fiber made ladder.
7.	Normalization of system	a) Grounding not removed isolator operation being done.	1. After surrendering the permit in Control Room clean the area and remove the grounding, thenallow for operation.
		b) Flash over due to wrong operation.	1. Before closing the isolator, it should be ensured that breaker of respective bay and earth switch are open. 2. The persons should have authorization for working in electrical systems.

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JHA on Maintenance of Lighting System in Hazardous Area

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Ladder/A frame platform Ladder, Screw Driver, and Spanner, proximity tester,
4. PPE required : Full body harness, Safety Helmet, insulated gloves
5. Authorization Required : Height pass, Confined area permit, electrical authorization

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Dismantling / opening of DB / Control gear / Fittings.	a) Explosion hazard from sparks	1. Ensure guaranteed isolation before starting the job. 2. Ensure that the system is de-energized from the farther end before opening the DB/Control gear. Confirm by proximity tester 3. Ground the system from the farther end to discharge any staticcharges. 4. Ensure ventilation system is `ON' and no accumulated explosive gases are present.
		b) Suffocation	1. Obtain confined area permit and clearance from competent person. 2. Ensure sufficient ventilation so that hazardous gases/fumes are not accumulated.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
		c) Slippage during movement	Ensure that the area is clean from oil/slippery material before working.
2.	Commissioning after maintenance	a) Fire hazard	1. Before putting back the system to service ensure the healthiness of gaskets/sealant of explosion proof fittings. 2. Ensure that the removed gaskets/ seals have been put back to the respective position. 3. Ensure that the screws/nuts of the covers and sealing plates are put back and tightened.

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JHA on Calibration and Testing of Electrical Relays.

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Power supply arrangement Relay testing/calibration kit, Multi meter, Megger, proximity tester, meter, combination contact setting plyer, Tools, spanner set, cleaning agent.
4. PPE required : Rubber mat, Hand gloves, insulated gloves, goggles
5. Authorization Required : Electrical authorization, Qualified and Trained Electrician and Supervisors.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Removal of Relay from panel	a) Electric shock to person	1. Persons should have authorization to work on electrical systems. 2. Work permit should be taken from Control room. 3. Control supply and protection signal should be off. Confirm by proximity tester. 4. Before removing the relay, check supply on relay terminal by Multi meter or before calibration check supply onrelays.
		b) Flash over and injury to persons.	1. Before switching off control supply, check that load breaker is off. 2. Relay should not be removed while control and protection supply is ON.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
2.	Testing of Relays	a) Electric shock	1. Persons should have authorization to work on electrical systems. 2. Make sure that supply taken to testing kit is healthy with earth wire. 3. Rubber mat should be available on ground near testing table. 4. Check Insulation Resistance of relay coil. 5. Check healthiness of leads used to give supply to testing of Relays.
		b) Flash over in Relays and testing kit.	1. Check healthiness of supply socket used for testing kit. 2. Make sure that supply switch is off before putting plug indistribution board. 3. Insulation Resistance (IR) and Winding Resistance (WR) should be checked before testing of Relays. Also, if testing Relays in the panel then wiring healthiness should be ensured. 4. Before testing of Relay,operating voltage should be noted and same should be used for calibration and testing. 5. Ensure that the temperature ofthe relay coil during testing is not beyond the limit. 6. Make sure proper cooling for testing kit and temperature of the testing kit should not be beyond the limit. 7. Ensure that phase and neutral of testing kit are connected correctly. Also check healthiness of the earth wire.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
3.	Setting of Relays and setting of contractgap	a) Electric shock	1. Contact setting nose player should be insulated. 2. Deploy skilled man power for job. 3. Care should be taken that at the time of setting, tools should not touch with another terminal of relay.
		b) Flash over in relays	1. Relays used for two voltages (AC voltage and DC voltage) care should be taken not to mix both voltages. 2. Care should be taken for relays which are having some electronic circuit to prevent heating of different component like capacitor, transistors and diodes.
4.	Check healthiness of Multi meter and testing kit.	a) Electric shock/ flashover	1. Make sure that Multi meter used for measuring the voltage checking contact position (open/ close is tested, healthiness and calibrated 2. Relay testing kit should be tested and calibrated by independent agency within prescribed schedule.
5.	Installation of Relays after calibration	a) Electric shock/flash over	1. Control supply switch should be off during re-installation of relays. 2. Wiring should be insulated by insulation tab after disconnecting from relays. 3. Use rubber Hand gloves. 4. Make sure that reinstalled Raelays are healthy.

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JHA on Working of UPS and DC System

1. Engineer - in - Charge : *NTPL*
2. Manpower required for the job : AT SITE WORK
3. Tools and tackles required : Multi meter, Megger, proximity tester, Tong Tester, Hydrometer, Thermometer, Portable Hydrogen detector, Power quality meter, Scope meter, Oscilloscope. Approach platform, cooling unit
4. PPE required : Safety shoes, Helmets, Apron, PVC shoes and Hand gloves. Insulated gloves.
5. Authorization Required : Work Permit, Qualified and trained Electricians and Supervisors are required, Electrical authorization

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
0.	Pre-job briefing as per NTPL Safety guide lines to be given to all the workersbefore commencement of the job by the Executing Engineer/Supervisor.		
1.	Working on charged/ commissioned UPS	a) Risk of failure of safety related system and consequential risk of fire.	1. Before request for issue of work permit for working, maintenance work of UPS and DC system, a plan/detailed Work permit system should be evolved 2. Procedure/alternate arrangement should be prepared by the Maintenance Engineer. Heshould also explain the Time duration and details of the work to team members. 3. Work permit should be obtained from Control Room.

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Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			4. When work is to be carried out on UPS, it should be specifically indicated that whether it has to be carried out on converter, inverter or battery circuit. Accordingly equipment to be affected/alternate arrangement to be spelled out. 5. When working on Electronic circuit, proper discharge of capacitance voltage to be done before taking up any maintenance work. 6. Maintenance work should only be started after checking the isolation required and tagging for the same by operation. 7. Insulation Resistance (IR) measurement should be done according to the voltage grade of circuit. 8. IR measurement on Electronic circuit should be avoided or Electronic circuits should be bypassed / separated from the power circuit.
		b) Risk of fire/Equipment damage due to poor power quality/DC output/AC output from the system	1. Ripples in DC output should be within the tolerance limit specified and it should be monitored on daily basis. 2. Power quality on AC outputfrom UPS should be monitored on daily basis through power quality analyzing scope meter.
		c) Risk of fire/Equipment damage due to second ground fault in the DC system or in Battery circuit of power UPS.	1. Immediate action need to betaken at the time of occurrence of ground fault.

Sl. No.	Sequence of the job	Potential Hazards	Protective measures to be taken
			2. While mitigation the ground fault on feeders, emphasis should be given for having alternate power supply source. 3. Bus ground fault detection and mitigation should always be taken in major plant shutdown. This has to be done by arranging alternate power supply.
		d) Risk of Electrocution	1. All works to be done by wearing insulated hand gloves. 2. Rubber mats should be provided in front of all panels. 3. Rubber mats are to be preferably pasted to floors and should be anti-skid. 4. Rubber mat should have been tested to withstand the voltage grade requirements.