



Hazard Identification and Risk Assessment (HIRA) for Renewables

RE-Safety Department



**Hazard Identification and Risk
Assessment (HIRA)**

Doc No: RE/HIRA/001

Revision: 0.0

Date: 24.11.2023

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1. Preface

NTPC – Renewables gives utmost importance to Safety, Health and Environment (SHE) in all its activities. This commitment is reinforced by choosing “Safety” as one of the core values. One of the principles of our safety policy is:

“Our activities carry various hazards; however, all hazards can be identified”.

Company firmly believes that “All accidents are preventable” and promotes safe working environment striving for “ZERO INCIDENTS” at work. Safe work results in

1. High Productivity
2. Positive work environment
3. Improved bottom lines
4. Better satisfaction to stakeholders

To translate the safety policy into standard practices with “ZERO INCIDENTS” outcome, a need was felt for identification of possible hazards, assessment of associated risks and their mitigation measures. NTPC renewables covers solar, wind, hydrogen and Hydrogen derived chemicals. All these domain pose specific hazards and therefore requires appropriate mitigation measures.

This HIRA document is being prepared to serve as a reference document for RE-sites. This will guide for identification of hazards, assessment of associated risks and their control measures to execute the jobs SAFELY. The Operation Control Procedures (OCPs) for working with ladders, scaffoldings, Hydra, Welding, etc. have been indicated for ready reference.

HIRA for Hydrogen working shall be added in the next revision in April 2024.

Sites may further augment this document as per site specific additional hazards.

2. Brief on Hazard Identification and Risk Assessment (HIRA)

Hazard Identification and Risk Analysis (HIRA) is a collective term that encompasses all activities involved in identifying hazards and evaluating risk at facilities, throughout their life cycle, to make certain that risks to employees, the public, equipment or the environment are consistently controlled.

Globally all safety Management Systems considers Hazard Identification and Risk Analysis (HIRA) as corner stone to establish a sound safety system. Moreover, industries are required to carry out HIRA for their different activities and operations as per statutory requirements. Considering importance of HIRA, the Bureau of Indian Standards has brought out a complete standard titled “Hazard Identification and Risk Analysis – Code of Practice” IS 15656:2006.

Relevant definitions are given below:

- a) **Hazard**: Source or situation with potential for harm, something that can cause body injury, occupational illness, damage of property etc.
- b) **Risk**: Risk is the chance or probability that a person or property will be harmed if exposed to a hazard. It also includes possibilities of adverse health effect to personnel.
- c) **Risk Assessment**: A systematic and structured process whereby hazards present in workplace, or arising from workplace activity, are identified, risks are evaluated.

Few others relevant definitions are given below:

Risk Mitigation: Risk mitigation is defined as the process of reducing risk exposure and minimizing the likelihood of an incident.

Competent person: As per OSHA, the Competent person is someone who is capable of recognizing and solving hazards in a workplace.

3. Five steps for HIRA

Renewables construction and operation workers are exposed to risk when they do a job. To minimize this, they should be more informed about various risk resulting from different hazards. A simplified five-step hazard and risk assessment along with control measures is given below.

1. Identification of a **Hazard**.
2. Identification of associated **Risk**.
3. Control of the risk, which Includes:
 1. Elimination / Substitution.
 2. Engineering barrier.
 3. Administration controls.
 4. Personal protection equipment.
4. Documentation of the HIRA process.
5. Monitoring and review of the HIRA process.

Step 1- Identification of hazard:

Extensive deliberation with different NTPC sites, and consultations with experts resulted in identification of 12 hazards in solar area and 20 hazards in wind area. These are specified in section 4 and 5.

Step 2- Identification of associated Risk:

The associated risk of identified 32 hazards are mentioned in section 6 and 7, respectively for solar and wind.

Step 3- Control of the risk:

The control measures of the identified hazards are mentioned in section 6 and 7. The assessment of individual risk is not performed separately but included while specifying control measures. The last column of the table in section 6 and 7 specify the controlled risk rating which is also an outcome of risk assessment.

Step 4- Documentation of the HIRA process:

Identification of hazard, associated risk, control measures and frequency are formalized in November 2023, which is part of this document.

A well accepted methodology for risk assessment is indicated in subsequent section which is adopted for our process.

Risk Index Matrix:							
Risk Level			Probability of Accident(O)				
			1	2	3	4	5
			Rare	Remote	Occasional	Frequent	Almost Certain
Severity of Accident(S)	5	Catastrophic	M	M	H	H	H
	4	Major	M	M	M	H	H
	3	Moderate	L	M	M	M	H
	2	Minor	L	M	M	M	M
	1	Negligible	L	L	L	M	M
Low Risk $O \times S \leq 3$ Green colour	Acceptable		No additional risk control measures may be needed. However, frequent review may be needed to ensure that the risk level assigned is accurate and does not increase over time.				
Medium Risk $4 \geq O \times S \leq 12$ Yellow colour	Moderately acceptable		A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as reasonably practicable within a defined time period. Interim risk control measures, such as administrative controls, may be implemented. Management attention is required.				
High Risk $15 \geq O \times S \leq 25$ Red colour	Not acceptable		Alternate arrangements to be made.				

Table 1: Probability/Likelihood of Accident		
Probability/ Likelihood	Rating	Description
Rare	1	Not expected to occur but still possible
Remote	2	Not likely to occur under normal circumstances
Occasional	3	Possible or known to occur
Frequent	4	Common occurrence
Almost Certain	5	Continual or repeating experience

Table 2: Severity of Accident/injury		
Consequence	Rating	Description
Catastrophic	5	Fatality, fatal diseases or multiple major injuries
Major	4	Serious injuries or life-threatening occupational disease (includes amputations, major fractures, multiple injuries, occupational cancer, acute poisoning)
Moderate	3	Injury requiring medical treatment or ill-health leading to disability (includes lacerations, burns, sprains, minor fractures, dermatitis, deafness and work-related upper
Minor	2	Injury or ill-health requiring first-aid only (includes minor cuts and bruises, irritation, ill-health with temporary discomfort)
Negligible	1	Not likely to cause injury or ill-health.

Step 5- Monitoring and review of HIRA:

The review of all identified hazards, associated risks, control measures and frequency of occurrence etc will be done every six months or whenever any incident happens.

4. Hazards in Solar power plants

4.1 Specific hazards from solar

There are specific hazards typical to a solar plant, as mentioned below:

- a. Solar module panel glare
- b. Snake and insect bite
- c. Back injury from lifting and working with solar panel
- d. Fire from stored packing materials, dry grass after grass cutting

4.2 Generic Hazards for Solar at ground level

1. Physical hazards
 - a. Trip and fall
 - b. Cut and bruises
2. Electrical hazards
 - a. Flash over and burn injury
 - b. Electrocutation
3. Hazards arising out of hot weather
 - a. Heat strokes
 - b. Sun burn
 - c. Dehydration
4. Fire Hazards
 - a. Fire in electrical equipment

4.3 Generic Hazards for floating Solar

1. Drowning

5. Hazards in Wind power plants

5.1 Specific hazards from land-based wind power

There are specific hazards typical to a land-based wind plant as mentioned below:

- a. Fall from height.
- b. Snake bite

5.2 Generic Hazards from wind power

- 1. Physical hazards
 - a. Trip and fall
 - b. Cut and bruises
- 2. Electrical hazards
 - a. Flash over and burn injury
 - b. Electrocution
- 3. Hazards arising out of hot weather
 - a. Heat strokes
 - b. Sun burn
 - c. Dehydration

6. HIRA for identified Hazards in Solar

A total of 12 hazards are identified for Solar area, as in Section 4. In following sections, HIRA and risk mitigation has been worked out and guidelines have been suggested for effective mitigation.

SL No.	Hazard identified	Associated Risk	Control measures	Probability (O)	Severity (S)	OxS	Risk Level
4.1a	Solar module panel glare	Vision problem Eye irritation	Use of sun glasses.	1	2	2	Low
4.1b	Snake bite Insect bite	Physical Injury/ fatality	<ol style="list-style-type: none"> 1. Spraying of Carbolic acid 2. Use of all required PPEs and Gumboots mandatory to all workers engaged in grass cutting. 3. Chemical Weeding at regular interval 	1	4	4	Medium
4.1c	Back injury from lifting solar panel	Physical injury like cut, bruises, Fracture	<ol style="list-style-type: none"> 1. Use of proper posture of body 2. Use of proper PPE 3. poster for awareness during lifting of heavy weight. 4. Organize Awareness lecture. 	1	2	2	Low
4.1d	Fire due to stored packing materials, Dry Grass after grass cutting.	Burn injury Properties damage	<ol style="list-style-type: none"> 1. Deployment of Trained personnel. 2. Arrangement portable fire extinguisher. 3. Use of required PPEs. 	1	2	2	Low

SL No.	Hazard identified	Associated Risk	Control measures	Probability (O)	Severity (S)	OxS	Risk Level
4.2.1 a	Trip and Fall	Physical injury fatality	<ol style="list-style-type: none"> 1. Regular inspection of work area for different in elevation, temporary obstruction, illumination, wet or slippery surfaces. 2. Regular training 3. Use of appropriate PPE such as Safety shoes, Safety helmet. 	1	4	4	Medium
4.2.1 b	Cut and bruises	Physical injury	<ol style="list-style-type: none"> 1. Use of hand gloves, safety shoes, safety helmet. 2. Posters for awareness. 3. Regular training 	2	3	6	Medium
4.2.2a	Flashover	<ul style="list-style-type: none"> • Equipment damage • Burn injury 	<ol style="list-style-type: none"> 1. Permit to work to be obtained. 2. Competent person for job. 3. Use of Arc flash suit. 	1	5	5	Medium
4.2.2b	Electrocution	Electrical shock could result into Fatality	<ol style="list-style-type: none"> 1. Competent person for the Job 2. SOP should be followed. 3. Permit to work to be obtained. 	1	5	5	Medium
4.2.3a	Heat strokes	<ul style="list-style-type: none"> • Unconsciousness • Nausea • Headache 	<ol style="list-style-type: none"> 1. If possible, use cold water for sprinkling generously to lower body temperature 2. Wear light weight cloths while working in hot weather. 3. Victim to be shifted immediately to nearest hospital. 	1	2	2	Low

SL No.	Hazard identified	Associated Risk	Control measures	Probability (O)	Severity (S)	OxS	Risk Level
4.2.3 b	Sun burn	Skin peeling, Tenderness, premature skin aging and skin cancer.	<ol style="list-style-type: none"> 1. Drink more water. 2. Sun screen 3. Full Cover the skin. 	2	1	2	Low
4.2.3c	Dehydration	<ul style="list-style-type: none"> • Diarrhea • Vomiting • Fatigue 	<ol style="list-style-type: none"> 1. Drink more water. 2. Use of ORS (Oral Rehydration Solution) 	1	2	2	Low
4.2.4a	Fire in electrical equipment	Physical injury Property damage	<ol style="list-style-type: none"> 1. Checking and preventing looseness of contacts. 2. Selection and use of fire extinguisher to take timely action and avoid secondary damage. 	1	2	2	Low
4.3.1	Drowning	Fall in water	Use of lifebuoy to prevent from drowning.	1	2	2	Low

7. HIRA for identified Hazards in Wind

A total of 09 hazards are identified for wind area, as in Section 5. In following sections, HIRA and risk mitigation has been worked out and guidelines have been suggested for effective mitigation.

SL No.	Hazard identified	Associated Risk	Control measures	Probability (O)	Severity (S)	OxS	Risk Level
5.1a	Fall from height.	Physical injury Fatality	<ol style="list-style-type: none"> 1. Use of Work at height permit. 2. Use of fall protection PPEs, Horizontal & vertical lifelines, Full body harness, Retractable fall arrester. 3. Barricading the area below the work activity. 	2	3	6	Medium
5.1b	Snake bite	Physical injury Fatality	<ol style="list-style-type: none"> 1. Spraying of Carbolic acid 2. Use of all required PPEs and Gumboots mandatory to all workers engaged in grass cutting. 3. Chemical Weeding at regular interval 	1	2	2	Low
5.2.1a	Trip and Fall	Physical injury / fatality	<ol style="list-style-type: none"> 1. Regular inspection of work area for different in elevation, temporary obstruction, illumination, wet or slippery surfaces. 2. Regular training 3. Use of appropriate PPE such as Safety shoes, Safety helmet. 	1	2	2	Low
5.2.1b	Cut and bruises	Physical injury	<ol style="list-style-type: none"> 1. Use of hand gloves, safety shoes, safety helmet. 2. Posters for awareness. 3. Regular training. 	1	2	2	Low
5.2.2a	Flashover	Equipment damage and Burn injury	<ol style="list-style-type: none"> 1. Permit to work to be obtained. 2. Competent person for job. 3. Use of Arc flash suit. 	2	3	6	Medium

SL No.	Hazard identified	Associated Risk	Control measures	Probability (O)	Severity (S)	OxS	Risk Level
5.2.2b	Electrocution	Electrical shock could result into Fatality	<ol style="list-style-type: none"> 1. Competent person for the Job. 2. SOP should be followed. 3. Permit to work to be obtained. 	1	3	3	Medium
5.2.3a	Heat strokes	<ul style="list-style-type: none"> • Unconsciousness • Nausea • Headache 	<ol style="list-style-type: none"> 1. If possible, use cold water for sprinkling generously to lower body temperature 2. Wear light weight cloths while working in hot weather. 3. Victim to be shifted immediately to nearest hospital. 	1	2	2	Low
5.2.3b	Sun burn	Skin peeling, Tenderness, premature skin aging and skin cancer.	<ol style="list-style-type: none"> 1. Drink more water. 2. Sun screen 3. Full Cover the skin. 	1	2	2	Low
5.2.3c	Dehydration	<ul style="list-style-type: none"> • Diarrhea • Vomiting • Fatigue 	<ol style="list-style-type: none"> 1. Drink more water. 2. Use of ORS (Oral Rehydration Solution) 	1	2	2	Low

Annexure -1: Operational Control Procedures (OCPs)

In following sections, six relevant OCPs for RE are mentioned which are formalized in NTPC's yellow book for safety (Electrical Mechanical hand book). These are for use of ladder, scaffolding, work at heights, Lifting gears, electrical works and arc welding.

OCP - 01 Ladder

Ladders are gradually replaced by scaffolds, platforms, and trestles over the years. Today even in the latest machinery, hydraulic ladders, scissors ladders, fork ladders are used extensively. However, ladders are still being used by workers. Some of the common hazards are due to overreach, slip, electric conductance, falls from ladders etc.

SI. NO	PROCEDURAL STEP	YES/ NO	REMARK (IF ANY)
1	<p>Before using any ladder check:</p> <ol style="list-style-type: none"> 1. If there are any visible defects i.e. bends, dents, cracks and completeness of components. 2. Suitability for work i.e. height according to work area, area of placing i.e. in vicinity of electrical lines, on uneven surfaces, slippery floor & stability of landing area etc. 3. Placement of feet with full contact on ground and also check if they are free from dug soil, loose soil and oil/grease. 4. Check all ladders used in a scaffold system Once a week 		
2	<p>The options for securing a ladder are as follows:</p> <ol style="list-style-type: none"> 1. Tie the ladder to a suitable point, making sure both top and bottom stiles are tied. 2. Where it is not possible to tie at top one person should hold the ladder. 		
3	<p>You should only use ladders or stepladders:</p> <ol style="list-style-type: none"> 1. Built ladders not more than 6 M and rung spacing not more than 300mm. 2. Where they will not be struck by vehicles, by protecting them with suitable barriers or cones. 3. Where they will not be pushed over by other hazards such as doors or windows, by securing doors (not fire exits) and windows where possible. If this is not possible, have a person standing guard at a doorway, or inform workers not to open windows until they are told to do so. 4. Where pedestrians are prevented from walking under them or near them, by using barriers, cones or as a last resort, a person standing guard at the base. The stiles of some ladders or the 1 in 4 rule (1 unit out for every 4 units up). 5. Don't use the top three rungs of a ladder. 		

SI. NO	PROCEDURAL STEP	YES/ NO	REMARK (IF ANY)
4	<p>Do's and Don'ts while using the ladders:</p> <ol style="list-style-type: none"> 1. Avoid overreaching and not maintaining three points of contact i.e. two hands and one foot or two foot and one hand should always in contact with the ladder. 2. Avoid multiple persons accessing the same ladder at same time. 3. Avoid overloading it, the person and anything they are taking up should not exceed the highest load stated on the ladder 		
5	Avoid makeshift arrangements at ladders i.e. placing wooden planks, metal pieces below the ladder footings		
6	Avoid side loading when working on stepladders such as side-on drilling at walls, door. Steps of the ladder should face the work activity.		
7	Avoid carrying material while ascending or descending the ladder		
8	Avoid using metallic ladders in the vicinity of electrical lines		
9	Avoid combining or jointing two individual ladders to access heights		
10	Avoid using ladder as walk way or working platform.		
11	Avoid accessing the ladder with shoes having the soles hanging off, have long or dangling laces, or be thick with mud or other slippery contaminants like grease, wasteoil etc.		
12	<p>Avoid trying to move / relocate any ladder while user is at ladder.</p> <p>Ladders used for access should project at least 1 m above the landing point and be tied. Alternatively, a safe and secure handhold should be available.</p>		

OCP - 02 Scaffolding

A scaffold includes any temporary structure, on which or from which person perform work. All those works that cannot be carried out conveniently from ground floor or with the use of ladders need scaffold. Accidents happen either due to collapse of the scaffold or fall of working personnel from scaffold besides the above, principal hazards are:

- a) Slippage of unsecured ladders.
- b) Use of unsuitable or faulty material.
- c) Inadequate support of scaffold board, irregular platform width.
- d) Omission of guard rails or toe boards.
- e) Overloading of platforms.

As per SP: 2001, the design of scaffolding needs the same skill and attention as the design of any permanent structure. The erector/agency shall ascertain from the manufacturer the safe load it can carry. The scaffold shall be checked before use.

Sl. NO	PROCEDURAL STEPS	YES/ NO	REMARK(IF ANY)
1	A scaffold shall only be constructed, taken down and substantially altered by competent person/ trained workman.		
2	Materials for construction of scaffolds shall be strong, free from defects and shall be sufficient for the intended load.		
3	Scaffolds shall be provided with safe means of access such as stairs, ladders, and ramps.		
4	Every scaffold shall be maintained in order, and once checked and inspected, every part shall remain fixed or secured and on no account shall any element be detached		
5	<ol style="list-style-type: none"> 1. At no time shall a scaffold be overloaded. 2. The load on the scaffold shall be evenly distributed as far as is practicable, and in any case shall be so distributed as to avoid any dangerous disturbance of the equilibrium. 		
6	<ol style="list-style-type: none"> 1. Do not use ladders and make shift devices on top of scaffold to increase the height. 2. While setting planks on platforms, it should overlap one foot on bearers and should arrest properly. The planks of scaffold should overhang not less than 6" on either ends but not more than 12". 		

SI. NO	PROCEDURAL STEPS	YES/ NO	REMARK (IF ANY)
7	Before erecting scaffolds near any electrical lines or near exposed electrical equipment, electrical supervisor must be consulted to determine what special precautions are to be taken and also great care should be taken for not making use of plant process pipelines / equipment for support purpose		
8	All structures and appliances used as supports for working platforms shall be of sound construction, have a firm footing and be adequately strutted and braced to make them stable.		
9	No working platform shall be used until its construction is completed and the necessary safeguards properly fixed. Every working platform from which a person is liable to fall a distance of more than 2m shall either be closely boarded.		
10	Planked or plated, or consist of open metal work. Every working platform shall be of sound construction, adequate strength and free from patent defect and shall be at least 60 cm in width.		
11	Width of working platforms and gangways for passage of persons only shall be at least 600mm and for gangways for passage of material at least 650 mm.		
12	Every person using it shall be wearing a safety harness, which shall be properly maintained. A notice in English and the local language shall be displayed prominently: -“Every person riding on a suspended platform shall wear a safetyharness properly attached to an independent lifeline or an appropriate anchorage.”		
13	Each scaffold shall be inspected by a responsible person: - once every 7 days; 1. Before use. 2. After amendment. or 3. After exposure to weather conditions likely to affect its Stability.		
14	A comprehensive checklist for inspection shall be, maintained for recording the deficiencies, rectification measures, names of persons responsible for taking action, proposed due date and completion dates.		
15	Personnel shall watch for over-head clearance when making a scaffold. casters shall be pinned. Locking Pins are in place at each joint.		

OCP - 03 Work at Heights

Significant hazards are associated at working at height. Fall of Person and material are amongst the severe most of them. Working at height may also lead to giddiness that might pave way for an untoward incidence. Advance Planning before taking up works at heights can effectively safeguard most of our interests.

Sl. NO	PROCEDURAL STEPS	YES/ NO	REMARK(IF ANY)
1	<p>Elevated work place:</p> <ol style="list-style-type: none"> 1. A work place more than 2 m above the floor or ground shall be protected on all open sides by guard – rails and toe boards complying with the requirements of Sl. No. 2 of this operational control procedure. 2. Elevated work place will be provided with safe means of access and egress. 3. Where necessary, persons employed at elevated work place or other work place from where they might fall more than 2 m shall be protected by means of adequate catch nets, sheets or platforms or be secured by safety belts with the life line properly attached. 		
2	<p>Use of Ladders</p> <ol style="list-style-type: none"> 1. Ladder shall not be used as work platform. 2. Ladders shall be of good construction with no missing or defective rungs, of sound material and of adequate strength for its intended use. 3. Ladder shall be erected on level and firm ground at an angle not exceeding 75 deg or a 4 (heights) : 1 (base) ratio. 4. Ladder to be secured at top when impracticable, firmly secured at base 		
3	<p>Use of Safety Nets</p> <ol style="list-style-type: none"> 1. When impracticable to provide adequate guardrails or platform access, safety nets will be erected. 2. If guardrails, platforms and nets are impracticable, safety harnesses shall be used to prevent injury due to fall of persons. 3. Safety nets if removed from access or movement of material shall be replaced as early as possible. 4. Suitable and sufficient anchorage fittings shall be provided for safety harnesses. 5. Safety nets and harnesses will be inspected and maintained. 6. Each person provided with harness shall wear it and keep it attached to a rescue anchorage while working from a place where a fall of 1.5m or more is possible. 		

OCP - 04 Lifting gears Crane/Hydra

There are Many hazards associated with lifting appliances and lifting gears such as fall of material, injury to workmen working on the appliances and obstruction to movements.

Sl. NO	PROCEDURAL STEPS	YES/ NO	REMARK(IF ANY)
1	<p>General</p> <ol style="list-style-type: none">1. Lifting appliances shall be installed under the supervision of a competent person.2. No structural alternation or repair shall be made on any part of the lifting appliances that affects the safety without the permission of the competent person.3. Every lifting appliance being operated outdoors should have a cabin for the protection of the operator against weather. All panes should be intact to stop rainwater.4. The maximum safe working load (SWL) shall be marked on the lifting appliance.5. No crane, hoist, winch or other lifting appliance, shall, except for testing purposes, be loaded beyond the SWL.6. Operators shall not leave lifting appliances unattended with power on or with a load suspended.7. During hoisting operations, effective precautions shall be taken to prevent any person from standing or passing under the load8. Lifting appliances (other than cranes, crabs and winches) shall be tested and thoroughly examined by a competent person after erection and thereafter tested every 5 years and inspected every 12 months.		

SI. NO	PROCEDURAL STEPS	YES/ NO	REMARK(IF ANY)
2	<p>Cranes</p> <ol style="list-style-type: none"> 1. Every crane shall be tested and thoroughly examined by a competent person after erection at site before put to use. 2. Every crane shall be fitted with: <ol style="list-style-type: none"> a. Angle indicator b. Plate inside the cabin showing safe working load at various radius of operations (Load Chart). c. Limit switches for boom and hoist Boom light, swing horn, flashing beacon. d. Safe Working Load (SWL) prominently painted on the crane body. e. ASLI (Actual Safe Load Indicator) or LMI (Load Mean Indicator) which will be shown weather lifting load is within the limit of SWL or not. (if possible) 		
3	<p>Cranes shall not be used for the following operations:</p> <ol style="list-style-type: none"> 1. To pull out fixed objects; 2. To drag objects or move vehicles or to lift an object with a slanting pull whether out of radius or sideways reach. 3. To lift material during bad weather which likely to endanger its stability. 4. To do lifting operations close proximity to electric power lines. 5. Swing area of the crane shall be barricaded and no one will enter the area when the crane is in operation. 6. When more than one crane is required to lift or lower one load i.e. Tandem Lifting. 7. Arrangements shall be such that none of the cranes will at any time be loaded beyond its SWL or be rendered unstable in the hoisting or lowering of the load. and 8. A competent person shall be specially appointed to co-ordinate the operation of the cranes working together. 		

Sl. NO.	PROCEDURAL STEPS	YES/ NO	REMARK (IF ANY)
4	<p>Test and examination shall be carried out by a registered examiner when:</p> <ol style="list-style-type: none"> 1. after each installation (or re-installation). 2. after major alternation. 3. after alteration of height of travel. 4. at intervals not exceeding 6 months. 		
5	<p>Lifting gear used in connection with cranes and lifting appliances</p> <ol style="list-style-type: none"> 1. A competent person shall inspect all lifting gear before they are put in use. 2. Manufacturers shall issue a test certificate. 3. When not in use, ropes, chains and accessories shall be stored under cover in clean, dry, well-ventilated places where they are protected against corrosion or other damage. 4. Slings that show evidence of cuts, excessive wear, distortion or other dangerous defects shall be withdrawn from use. 5. Wire rope slings shall be kept well lubricated. 6. Sharp bends of loads shall be padded by semicircular metallic pipe pieces or rubber pads etc. 7. When multiple slings are used, load shall be equally distributed. 8. Where double or multiple slings are used, the upper ends of the slings shall be connected by means of a shackle or a ring and not be put separately into a lifting hook. 9. Eye splices and loops of wire ropes shall be provided with thimbles. 10. Hooks shall be provided with a spring-loaded safety latch to prevent the load from slipping. 11. Slings shall be colour coded periodically. 		

Records

1. Test and inspection certificates.
2. Details and License of operator.

OCP - 05 Electrical Works

Electrical Works call for attentiveness and knowledge of the work in addition to adoption of proper Permit to-work system. It involves working at heights working under live sections of electric networks and in close proximity of high voltages. The workers must be briefed about the minimum safe working clearances that must be maintained from all live parts. Rubber gloves and Safety Shoes (Electrical Grade) must be used at all times. All equipment must be earthed securely before commencement of work.

Sl. NO	PROCEDURAL STEPS	YES/ NO	REMARK(IF ANY)
1	All works on existing electrical installation to be carried out under Permit To- Work		
2	Only authorized and licensed electricians shall be allowed to work, helpers will be restricted to only carry tools, materials and assist in holding ladders and such like tasks.		
3	<u>General:</u> <ol style="list-style-type: none">1. Only industrial type electrical fittings shall be used.2. No loose connections shall be permitted which are the prime factors in electrical fires.3. Electricians will use rubber hand gloves while working on live connections and shall stand on rubber mats.4. Appropriate danger signs shall be installed outside electrical installations and at DG rooms.		
4	<u>Switchboards:</u> <ol style="list-style-type: none">1. All switchboards shall be free from obstructions and to be barricaded.2. Shall be fitted with signs of the supply voltage and DANGER.3. All distribution boards (DB's) shall be lockable.4. Proper earthing from more than one earthing pit duly interconnected shall be provided.5. All DB's shall be provided with 30 mA rating ELCB's.6. All switchboards and DB's shall be provided with adequate protection from rainwater i.e. canopy but not with polythene or plastic sheets.		

Sl. NO.	PROCEDURAL STEPS	YES/ NO	REMARK (IF ANY)
5	<p><u>Conductors:</u></p> <ol style="list-style-type: none"> 1. No bare conductor shall be permitted. 2. All wiring shall be supported on proper insulators and the insulation of all electric portable cables shall be of heavy-duty types. 3. Overhead lines shall be carried on wooden support of adequate strength and at a minimum height of 10' above ground level and they should not tie with any conducting materials like binding, GI wire. 4. Vehicle movement beneath these lines should be restricted by displaying warning sign board 5. Only heavy-duty conductors shall be laid underground and their route shall be properly marked by cable markers and also at Cable lay out display. 6. If plug socket connections are required for connecting cables to the mains, they shall be:- <ol style="list-style-type: none"> a. Properly paired. b. of water proof type. c. of adequate design. 		
	<p>A single flexible cable shall supply:</p> <ol style="list-style-type: none"> 1. All flexible cables shall be joined by means of a proper connection or by appropriate industrial plugs and sockets. 2. Flexible cables shall not be used to lift a portable tool. 3. Only rubber insulated flexible cables shall be used. <p>Electrical Equipment:</p> <ol style="list-style-type: none"> 1. Double earthing is must. 2. Control appliances shall not be installed at places where there are flammable liquids/gases i.e. near to Diesel / Gas cylinder storage yard. 3. Conductors shall be joined, branched or led into apparatus through junction boxes, sleeves, bushings, glands or equivalent connecting devices. 4. Hand lamps shall be equipped with metallic mesh protection for glass and all current-carrying parts enclosed together with an insulated handle. 		

Sl. NO.	PROCEDURAL STEPS	YES/ NO	REMARK (IF ANY)
7	<p><u>Working Near Overhead Electricity Lines:</u></p> <ol style="list-style-type: none"> 1. If possible, shutdown to be obtained from the concerned authorities in writing. 2. Treat any O/H lines found anywhere as LIVE. 3. Working too close or causing damage to O/H lines is dangerous as it can lead to flashover, explosion or fire. 4. Avoid working and erecting structures (e.g. scaffolding) unnecessarily directly under the O/H lines. 5. In case of works if there is any doubt on the ground clearance, voltage, safe working distance or working procedure, contact the electricity supplier and clear all doubts before commencing work. 6. If there is any vehicle movement beneath the O/H lines a barrier with safe clearance from O/H lines to be arranged. 		

Records to be maintained

1. ELCB inspection Report.
2. Electrical Inspection Checklist.
3. Work Permit.

OCP - 06 Hot Work (Arc Welding)

SI. NO	PROCEDURAL STEPS	YES/ NO	REMARK (IF ANY)
1	Welding set, cable and electrode should be confirmed to ISI and the same shall be checked at regular interval for any defects.		
2	The primary supply to the welding machine should be given through RCCB of 30mA.		
3	Power supply cable should be properly connected through switchboard / isolator by a trained electrician.		
4	The welding machine should be efficiently grounded to protect against any leakage of current		
5	Welding cables with lugs should be properly tightened in the secondary terminals		
6	A separate earthing cable should be drawn from the earthing lead of the welding set to the nearest point of welding, so that current travels the least distance. Open metal wire, strip or rod should not be used for earthing. Earthing should not be given to pipe rack, column, Instrument supports or vessel containing inflammable liquid or vapor.		
7	Never change the electrode with wet hand or with wet hand gloves.		
8	There are possibilities that gases and fumes produced during welding & cutting may affect the respiratory system.		
9	Local exhaust system and good ventilation should be provided at the work place.		
10	The person associated with welding job should wear welding helmet.		
11	Leather apron, chrome leather hand gloves, helmet, shoes, etc., should be worn.		
12	For overhead welding, cover the ears so that the ear does not come into electrical path.		
13	To avoid over heating due to loose connection, Provide efficient connection of cables by fixing lugs at ends and clamp it properly. All joints should be properly insulated.		
14	After completion of the job, cable should be arranged in a circular loop. During welding & cutting it should not come in contact with sparks.		
15	All flammable materials to be removed in the affected areas and at lower levels. After completion of work, check if there is a any smoldering or burning around or below.		
16	Obtain PTW from SO/ SSI for welding on / inside any pressure vessels containing or contained flammable/ explosive material.		

Annexure -2 : Common procedure for electrical isolation

1. **Required common precautions during isolation and normalisation:**

1. Electrical Safety shoes, Hand Gloves of proper Voltage Rating, Helmet.
2. Working exclusively by trained and authorized person only.
3. Display of Shock treatment chart.
4. Ensure availability of insulation mat in front of the panel before starting of the job.
5. Ensuring the deployment of appropriate type of Fire extinguishers nearby.

2. **'Isolation' procedure of HT breaker:**

1. First collect 'Danger Tag' for the concerned Drive/ Equipment to be isolated.
2. The Equipment/ Drive Name and Breaker/ Module location (Switchgear Name and Panel Number) must be mentioned in 'Isolation Slip'/ 'Danger Tag'.
3. Ensure the concerned Breaker is in 'OFF' condition by looking at Flag as well as 'OFF' indication lamp.
4. In case of Module, ensure 'OFF' indication lamp is glowing.
5. In case of Breaker, make Panel DC 'OFF' by opening the upper compartment door and then close the compartment door properly.
6. Now 'Selector Handle' position is to be changed from 'SERVICE' to 'MOVEMENT' position.
7. Insert the Breaker Rack-out Handle and rotate Anti- clockwise until 'TEST' position Mark is visible.
8. Remove the Rack-out Handle and 'Selector Handle' position is to be changed from 'MOVEMENT' to 'TEST' position.
9. Note down the 'Castle Key' number and rotate Anti-clockwise to remove the 'Castle Key'.

3. **'Normalisation' procedure of HT breaker:**

1. Match the Equipment/ Drive Name and Breaker/ Module Number as mentioned in 'Normalisation Slip'.
2. Ensure Panel DC is in 'OFF' condition and check the Breaker is in 'TEST' position.
3. Insert the Castle Key in proper manner and rotate Clockwise.
4. Change the 'Selector Handle' position from 'TEST' to 'MOVEMENT' position.
5. Insert the Breaker Rack-in Handle and rotate Clockwise gently until 'SERVICE' position Mark is visible.
6. Make Breaker Panel DC 'ON' by opening the upper compartment door and then close the compartment door properly.
7. Now 'Selector Handle' position is to be changed from 'MOVEMENT' to 'SERVICE' position.
8. Ensure following Indication Lamps are glowing properly:

- a. Breaker OFF
 - b. Spring Charged
 - c. Breaker in Service
 - d. Trip Circuit Healthy
 - e. Trip Relay Healthy
9. Ensure 'Gas Pressure Low' Relay (96) is not in operated condition.
 10. N.B. During Breaker Rack-in/ Rack-out if any abnormal jamming is faced, concerned EMD personnel must be contacted.
 11. Always ensure before Breaker Isolation/ Normalization that Floor Insulation Mat is in position.
 12. Only Authorized and Skilled persons should handle the Breaker.

4. ISOLATION PROCEDURE OF LT BREAKER:

1. First collect 'Danger Tag & Isolation Slip' for the concerned Drive/ Equipment to be isolated.
2. The Equipment/ Drive Name and Breaker/ Module location (Switchgear Name and Panel).
3. Number must be mentioned in 'Isolation Slip' & 'Danger Tag'.
4. Ensure concerned Breaker is in 'OFF' condition by looking at Flag as well as 'OFF' indication lamp.
5. In case of Module, ensure the 'OFF' indication lamp is glowing.
6. Make Panel DC 'OFF' from the Upper Compartment.
7. Open the Isolation Cover in front of Middle Compartment by rotating the Knob anti-clockwise.
8. Now to open the Flap Cover press the Emergency Push Button and simultaneously rotate the Flap Screw Clockwise using a Screw-Driver.
9. Insert the Breaker Rack-out Handle and lift Upward, first 'TEST' position Mark will be visible. Remove the Handle and reinsert it in the lower groove, on further lifting upward, 'ISOLATE' position Mark will appear.
10. Remove the Rack-out Handle and Close the Flap Cover.
11. Close the Isolation Cover.
12. Remove the Castle Key by rotating it Anti-Clockwise.

5. NORMALISATION PROCEDURE OF LT BREAKER:

1. Match the Equipment/ Drive Name and Breaker/ Module Number as mentioned in 'Normalisation Slip'.
2. Ensure Panel DC is in 'OFF' condition and check the Breaker is in 'ISOLATE' position.
3. Insert the Castle Key and rotate Clockwise.
4. Open the Isolation Cover in front of Middle Compartment by rotating the Knob anti-

clockwise.

5. Now to open the Flap Cover press the Emergency Push Button and simultaneously rotate the Flap Screw Clockwise using a Screw-Driver.
 6. Insert the Breaker Rack-in Handle and push downward, first 'TEST' position Mark will be visible.
 7. Remove the Handle and reinsert it in the upper groove, on further pushing downward, 'SERVICE' position Mark will appear.
 8. Remove the Rack-out Handle and Close the Flap Cover.
 9. Close the Isolation Cover.
 10. Make Breaker Panel DC 'ON' from upper compartment.
 11. Ensure Selector Switch (on Upper Compartment) is in 'NORMAL' position.
 12. Ensure following Indication Lamps are glowing properly:
 - a. Breaker OFF
 - b. Spring Charged
 - c. Trip Relay Healthy
 13. During Breaker Rack-in/ Rack-out if any abnormal jamming is faced, concerned EMD personnel must be contacted.
 14. Always ensure before Breaker Isolation/ Normalization that Floor Insulation Mat is in position.
 15. Only Authorized and Skilled persons should handle the Breaker.
6. **ISOLATION PROCEDURE OF LT MODULE:**
1. First collect 'Danger Tag & Isolation Slip' for the concerned Drive/ Equipment to be isolated.
 2. The Equipment/ Drive Name and Module location (Switchgear Name and Panel Number) must be mentioned in 'Isolation Slip'/ 'Danger Tag'.
 3. Ensure concerned module is in 'OFF' condition by looking at the 'OFF' indication lamp.
 4. Make isolator OFF (At the time of module OFF, it makes sound).
 5. Open the panel door cover & confirm isolator marking knob is in "0" position.
 6. Properly lock the Power fuse with the Fuse Puller and remove the fuses.
 7. Remove the control fuses (F106 & NLO).
 8. If required remove fuse, F107 for space heater.
 9. All power and control fuses are to be kept in safe place.
 10. Close the module Cover properly.
 11. Place the danger tag.

7. NORMALISATION PROCEDURE OF LT MODULE :

1. First collect 'Normalization Slip' for the concerned Drive/ Equipment to be normalized.
2. The Equipment/ Drive Name and Module location (Switchgear Name and Panel Number) must be mentioned in 'Normalization Slip'.
3. Ensure concerned module is in 'OFF' condition.
4. Open the panel door cover & confirm isolator marking knob is in "0" position.
5. Properly lock the Power fuse with the Fuse Puller and insert the fuses one by one.
6. Place the control fuses (F106 & NLO) at the proper fuse base.
7. Place control and space heater fuse.
8. Close the module Cover properly.
9. Make isolator "ON" (At the time of module ON, it makes sound).
10. Match the Equipment/ Drive Name and Breaker/ Module Number as mentioned in 'Normalization Slip'.
11. Ensure Panel DC is in "OFF" condition and check the Breaker is in 'ISOLATE' position.
12. Insert the Castle Key and rotate Clockwise.
13. Open the Isolation Cover in front of Middle Compartment by rotating the Knob anti-clockwise.
14. Now to open the Flap Cover press the Emergency Push Button and simultaneously rotate the Flap Screw Clockwise using a Screw-Driver.
15. Insert the Breaker Rack-in Handle and push downward, first 'TEST' position Mark will be visible.
16. Remove the Handle and reinsert it in the upper groove, on further pushing downward,
17. 'SERVICE' position Mark will appear.
18. Remove the Rack-out Handle and Close the Flap Cover.
19. Close the Isolation Cover.
20. Make Breaker Panel DC 'ON' from upper compartment.
21. Ensure Selector Switch (on Upper Compartment) is in 'NORMAL' position.
22. Ensure following Indication Lamps are glowing properly:
 1. Breaker OFF
 2. Spring Charged
 3. Trip Relay Healthy
23. During Breaker Rack-in/ Rack-out if any abnormal jamming is faced, concerned EMD personnel must be contacted.
24. Always ensure before Breaker Isolation/ Normalisation that Floor Insulation Mat is in position.