SAFETY STANDARDS

No. RERC/ Secy/ Safety Standards Date: 5th January 2004

In exercise of powers conferred on it by Section- 9 (1) (l) of the Rajasthan Power Sector Reforms Act, 1999 and all powers enabling it in that behalf the Rajasthan Electricity Regulatory Commission (RERC) makes the Safety Standards.

0.1 Short title, Commencement and Scope:

(i) These standards shall be called Safety Standards.
(ii) These shall be followed to the extent applicable by all licencees and generating companies operating in the State of Rajasthan.
(iii) They shall come into force on the date of their publication in the Rajasthan Gazette.

0.2 Definitions:

i 'Act' shall mean the Rajasthan Power Sector Reforms Act 1999.
ii 'Commission' shall mean Rajasthan Electricity Regulatory Commission.
iii 'Electrical Inspector or Inspector' shall have the meaning assigned to it in the Indian Electricity Rules 1956.
iv "EHV" means Extra High Voltage (132 kV and above)
v "GRID CODE" means the code prepared by the Licensee in accordance with clause 12 of the Transmission and Bulk Supply Licence
vi "GSS" means Grid Sub Station i.e. Sub Station of system voltage exceeding 33 kV
vii 'Licencee' shall mean utilities engaged in the business of transmission of energy and / or supply of energy to the licencees or consumers.
viii "NREB" means Northern Regional Electricity Board
ix "NRLDC" means Northern Regional Load Dispatch Centre
x 'Officer' shall mean Officer of Licensee.
xi "PTW" means Permit to Work
xii "RULES" means the Indian Electricity Rules, 1956.
xiii 'RVPN' shall mean Rajasthan Rajya Vidyut Prasaran Nigam Limited i.e. transmission & bulk supply licensee.
xiv "SLDC" means State Load Dispatch Centre

xv "SSGS" means State Sector Generating Stations
xvi "Sub-Transmission" means electrical system where voltage exceeds 650 Volt and does not exceed 33000 Volts.
xvii VVNL-shall mean distribution licensee.

Other terms used in these standards shall have meaning as defined in the Reforms Act & Rules & Regulations framed there under.

0.3 Scope:

(i) Safety of consumers and maintenance staff of the utilities is of prime importance from hazards of electric shock, which may be caused in the transmission & distribution system. These standards aim at ensuring safety for construction and maintenance personnel of the Licensee as also other personnel including personnel of contractor, Generation Companies and members of general public from hazards of electric shock, which may be caused while working with Licencee's systems. The Licensee shall prepare a Safety Manual based on these Standards for internal use. The Safety Manual shall be prepared such that all the aspects and safety procedures to be followed are covered in a complete manner without inviting reference to any other Codes or Standards. Any references if required, be appended to the manual. Details of working zones and necessary isolations required for working on each equipment/line shall be clearly furnished in the Safety Manual. The Safety Manual shall also lay down foolproof procedures for issue of necessary permits and clearances (hereinafter called as "Permit to Work" or PTW) to the designated officer seeking such permits. The designated officer authorized to issue and receive such permits, shall be notified from time to time. A draft procedure for issue of PTW for inter-user boundary is appended at Annexure-A

(ii) It is the duty of all persons who may be connected with the installation, operation and maintenance of electric lines and apparatus to make themselves thoroughly conversant with the regulations and safety rules governing the work they may have to undertake on these lines and apparatus.

(iii) These standards are in addition to or an elaboration of the Indian Electricity Act, 1910 and Indian Electricity Rules, 1956, to be complied with by licensee, generator, owners of premises and consumers.

(iv) Safety instructions laid down by electricity supply undertakings in the form of safety rules or standing orders for guidance of staff employed in connection with the execution of work on or near electric lines and apparatus and for their operation and maintenance should be in consonance with IE Act, IE Rules & these standards and should be strictly

complied with at all times.

(v) It shall be the responsibility of the designated officer to interpret and explain correctly the rules and regulations to all concerned staff and to ensure that the staff thoroughly understands the same.

(vi) For the purpose of these standards, a competent person is one who had been certified so by the State Government, for specific category of electrical work, as laid down in Rule 45 of the IE Rules 1956.

(vii) Transmission or Distribution licensee or generating company, shall arrange regular training/ refresher courses to specified percentages of operating staff (including Junior Engineer) every year on operational aspects, including safety. In addition, periodical field level meetings shall be held to educate operating staff about the requirement of safety.

0.4 Reporting of Accidents:

(Rule No. 44A of IE Rules 1956)

(i) If any accident occurs in connection with the generation, transmission, supply or use of energy in or in connection with any part of electric supply lines or other works of any person and the accident results in or is likely to have resulted in loss of human or animal life or in any injury to a human being or an animal, such person or any authorized person of the RVPN/ VVNLs/supplier, not below the rank of Junior Engineer or equivalent shall send to the Inspector a telegraphic report within 24 hours of the knowledge of the occurrence of the fatal accident and a written report in a form set out in annexure-XIII of IE Rules within 48 hours of the knowledge of the occurrence of the fatal accident and all other accidents. Where practicable a telephonic message should also be given to the Inspector immediately the accident comes to the knowledge of authorized offer of RVPN/ VVNLs/ Supplier or other person concerned. A draft of accident reporting procedure is attached at Annexure-B.

(ii) Irrespective of enquiry by electrical Inspector duly authorized officer of licensee (not below the rank of Executive Engineer) shall conduct a detailed enquiry into every electrical/mechanical accident within a period not exceeding fifteen days, to guard against the possibility of destruction or disappearance of material evidence being presented and to escape responsibility. Non-operation of protective relay shall be deemed to be cause of electrical accident and shall also be enquired. The enquiry in general shall fix the responsibility for the accident but it is more important that enquiry shall spell out technical and other reasons which caused electrical accident including failure of protective relays, in adequate clearance, deficiencies in licensee's stand ards/codes/standing instruction etc. to prevent recurrence of such accident. Remedial measures to be adopted to avoid its reoccurrence shall also be

suggested.

0.5 These Standards consist of six Sections:

Section 1: General Precautions and Grounding measures
Section 2: Safety measures in construction and maintenance works in Transmission & Distribution Lines.
Section 3: Safety measures in construction and maintenance works in Sub Stations.
Section 4: Safety measures in operation of sub-stations, transmission & distribution lines.
Section 5: Additional Safety requirements in generating stations (to be added later on)
Section 6: Public Safety

0.6 Review

0.6.1 This standard shall be reviewed as and when:-

(i) CEA notifies rules/ code/ standards (referred to as `safety code') specifying measures for safety under section 53 and section 177 (2) (b) of the Electricity Act 2003.
(ii) Any change is effected in `Safety Code' or Indian Electricity Rules or Indian Standards referred to in these standards or with the issue of new Indian Standards relevant to safety.
(iii) Any difficulty is encountered in enforcing these standards or any deficiency is observed during its implementation.

0.6.2 For the contingencies mentioned at clause 0.6.1, the Commission may suo-moto or on the application made by any utility or any person initiate proceedings for review and effect amendments to these standards. Any change in Indian Electricity Rules or `Safety Code' or relevant Indian Standards shall be brought to the notice of the Commission by the utility within 30 days with the proposed amendments to these standards. In the meanwhile, revised provisions of Indian Electricity Rules or Safety Code shall prevail.

SECTION-1

GENERAL PRECAUTIONS AND GROUNDING MEASURES:

1.1 All conductors and equipment in the vicinity and not covered by PTW, shall be treated as energized. The designated officer shall ascertain the following conditions before permitting workmen to commence work:

(a) The lines or equipment are de-energized and grounded,
(b) Any hazards of induced voltages are not present,
(c) Adequate clearance as per clause 1.15 are maintained or other means are implemented to prevent contact with energized lines or equipment, and or line / equipment under PTW.

1.2 Bare wires of telecommunication lines if any, on power lines or structures, which are not protected by insulating materials shall be treated as energized.

1.3 The following procedure shall be adopted for deenergizing lines and equipment in cases where means of disconnection from electricity supply is not visibly open:

(a) The Particular section of line or equipment to be deenegized shall be clearly identified and isolated from all sources of voltage.
(b) For each transmission line/equipment, the designated authority authorized to issue a PTW shall take the following precautions:
(i) The circuit breakers and associated isolators through which there is a possibility of supply of electrical energy to the particular section of the line or equipment to be worked upon shall be kept open. In addition to circuit breakers, its associated isolator need always be opened before taking up any work on deenergised line/ system.
(ii) Caution Boards indicating "Men at Work" shall be fixed on panels from which all the above circuit breakers and isolators are operated.
(iii) If design of circuit breakers and isolators permit automatic operation or operation from a remote place, the same shall be rendered inoperable.
(iv) Isolators / grounded switches are usually provided with padlocking arrangement for both open and closed positions. Where such facility exists, normally isolators are padlocked in

open and ground switch in closed position before issuing permit to work (PTW) to avoid inadvertent operation.

(c) Once all the required circuit breakers and switches have been opened and rendered inoperable, visual inspection shall be carried out to ensure physical separation from energized system or otherwise ascertaining through communication from other end of line. Grounding of the line / equipment shall be made and only thereafter testing for voltage be conducted before accessing the line or equipment. Testing of de-energized and grounded line / equipment can be safely carried out by normal "multimeter" as grounding ensures practically no voltage on line / equipment.

(d) Protective grounds shall be provided to the disconnected lines or equipment to be worked on. If there is any grounding switch available in disconnected portion, the same shall be closed.

(e) Guards or barriers duly mounted cautioned marks/plates shall be erected wherever found necessary to the adjacent energized lines.

(f) When more than one independent crew requires PTW for the same line or equipment, each one should obtain separate PTW. The designated officer/official in charge (for each such independent crew) shall place a "Work in Progress" board on all line or equipment or its control gear.

1.4 On completion of work on de-energized lines or equipment, each crew in charge shall ensure the following:

(a) All the employees in his crew are clear off the work site and accounted for, and

(b) Only after ascertaining that protective grounds installed by his crew have been removed, the crew in charge shall report to the holder of PTW that all tags demarcating the work area may be removed.

1.5 When attaching grounds, the ground end shall be attached first, and then the other end shall be attached to the equipment or line by means of insulated tools or other suitable devices.

1.6 While removing the grounds after completion of work, the attachment at the conductor or line end shall be removed by means of insulated tools or other devices before the grounding at ground end is removed.

1.7 While working on line or sub-station equipment, grounding provided on tower / pole or sub-station should be used. Such grounds should be made/ remixed by means of insulated tools or devices.

1.8 In some cases establishing a ground connection to any equipment may become impracticable or the conditions resulting there-from would be more hazardous. In such cases working on lines or

equipment without grounding such equipment may be permitted and the ungrounded line or equipment shall be treated as energized for working purposes even though they may have been disconnected from the source of electric supply.

1.9 Grounds may be temporarily removed only when necessary for test purposes. Extreme caution shall be exercised during such test procedures.

1.10 The ground electrodes shall have a resistance to ground as low as possible so that they may not cause any danger or harm to the working personnel due to induced voltages. In case of any accidental contact with live conductors, either the voltage rise shall be too small to cause any shock hazards or the same shall result isolation of the circuit causing the voltage rise by fast acting relays.

1.11 The minimum size of ground lead shall be 70 sq.mm PVC insulated aluminum or 2 SWG copper. The earth electrodes for temporary earths shall be of mild steel rods of at least 20mm diameter and 1524mm length. These shall have clean metal surfaces, free from rust or any coating of paint or other poor conducting material and be driven to a depth of at least one meter in a spot considered to give good earth. The earth leads shall be connected to the ground rod using an appropriate crimped terminal for the lead and through suitable bolts and nuts to the ground rod. Earthingchains, used for grounding overhead lines up to 33kV voltage, shall be made of brass wire rods of dia 1.5 mm. The length of each chain shall be 9 meters and it shall be provided with a electro plated steel ball weight at one end and a brass clip (like battery terminal) at the other end. The brass ball shall be round in shape and shall be of 30 gms. approximately. The weight of each link shall be 15 gms. approximately. The weight of complete chain shall be approx. 400 gms.

1.12 Grounding of generating stations, grid sub stations & sub stations shall be checked periodically.

1.13 Fire Protection & First Aid

(a) In addition to fire extinguishers suitable for dealing with electric fires fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires, shall be conspicuously marked and kept in all generating stations, enclosed sub-stations and switch stations at convenient situations. The fire extinguishers shall be tested for satisfactory operation at least once a year and record of such tests shall be maintained.

(b) First-aid boxes or cupboards, conspicuously marked and equipped with such contents as the State Government may specify, shall be provided and maintained in every generating station enclosed sub-station and enclosed switching station so as to be readily accessible

during all working hours. Except in the case of unattended sub-stations and switch stations, all such boxes and cupboards shall be kept in charge of responsible persons, who are trained in first-aid treatment. One of such person shall be available during working hours.

(c) Instructions to avoid electrocution, provisions of first aid and safety against spillage/ fumes of electrolytes (acid or alkali) of battery are to be displayed in each sub station.

(d) Safety devices like insulated pliers, hand gloves, helmets, insulated shoes, safety belts, insulated crimping tools, insulated mats should be provided for employees / operators working at generating station/ sub station/ grid sub-stations.

(e) No employee shall be allowed to work without using safety devices like insulated pliers, hand gloves, helmets, and insulated mat etc.

1.14 Wherever infringement of clearances, with respect to provisions of rule 79 & 80 of IE Rules are observed during inspection or otherwise, action as per Rule 79 of IE Rules will be taken and rectification will be effected at owner's cost & if owner's responsib ility could not be fixed then at supplier's cost (Ref rule 79).

1.15 The following minimum safety working clearances shall be maintained for the bare conductors or live parts of any apparatus in outdoor sub-stations, excluding overhead lines of HV and EHV installations.

Highest System Voltage (KV)	Safety working clearances (Meters) (As per rule 64 (2) (a) (ii) of IE Rules)
12	2.6
36	2.8
72.5	3.1
145	3.7
245	4.3
420	6.4

Notes: -

(1) The above values are valid for altitude not exceeding 1000 meter (m). A correction factor of 1.25 per cent per 100m is to be applied for increasing the clearance for altitudes more than 1000m and up to 3000m.

(2) The above safety working clearances are based on an insulation height of 2.44 m which is the height of lowest point on the insulator (where it meets the earthed metal) from the ground.

(3) "Safety Working Clearance" is the minimum clearance to be

maintained in air between the live part of the equipment on one hand and earth or another piece of equipment or conductor on which it is necessary to carry out the work, on the other.

(4) The "Highest System Voltage" is de fined as the highest rms phase to phase voltage which occurs under normal operating conditions at any time and at any point of the system. It excludes voltage transients (such as those due to system switching) and temporary voltage variations due to abnormal system conditions (such as those due to fault conditions or the sudden disconnection of large loads).

1.16 While working at night, operation area will be well lighted by torches/focused lights etc.

SECTION-2

SAFETY MEASURES IN CONSTRUCTION AND MAINTENANCE WORKS OF TRANSMISSION /SUBTRANSMISSION/ DISTRIBUTION LINES

(A) TRANSMISSION/ SUBTRANSMISSION & DISTRIBUTION LINES

2.1 The excavation for pad or pile type foundations in excess of 1.5 mtr, depth located on unstable earth, shall be either sloped to the angle of repose or shored if entry is required. Ladders shall be provided for access to pad or pile type-footing excavations in excess of 1.2 mtr.

2.2 Wherever the foundation is being constructed on unstable earth, the workmen shall not be permitted to enter the excavated pit unless shoring is used to protect them.

2.3 Only responsible and skilled employees shall be deployed for directing mobile equipment adjacent to footing excavation.

2.4 No workmen shall be permitted to remain in the excavated pit where concreting is done using machinery.

2.5 The mobile equipment shall be located only on leveled earth to ensure stability.

2.6 Sufficient care shall be taken during tower erection to see that more than the minimum number of workmen is not deployed. This will minimize exposure of falling objects on workmen, when working at two or more levels. Proper protection such as use of helmets, safety belts etc., shall be taken.

2.7 Tie ropes shall be used wherever necessary for maintaining steel sections or other parts in position to reduce the possibility of tilting etc.

2.8 Adequate supports shall be provided for the tower members and sections of panels during assembly.

2.9 The construction of Transmission towers, erection of poles, tools and machinery being used for the work shall meet the requirements of the relevant Indian Standard Specifications and Code of Practices along with the CBIP manual on Transmission Lines. The wire ropes, pulley blocks etc., shall be of tested quality and inspected by a responsible employee for its fitness before commencing the work.

2.10 Other than the supervisory staff and such of the workmen required to guide and assist the section being erected, no one else shall be permitted to come under a tower being erected.

2.11 If hoisting equipment are used for erection of towers adjacent to existing transmission lines, the lines shall be de-enegized wherever possible. When this is not practicable, extraordinary precautions shall be exercised to maintain the minimum clearances required including those mentioned in sub clause 1.15 of section-1.

2.12 (a) All practical steps shall be taken to prevent operating the earth moving, lifting and housing machinery in dangerous proximity to a live overhead power line. In particular, any part (s) of such machinery shall not be permitted to approach as per clause 3.1.5.1 of IS 7293-1974 within the following distance of overhead power lines:

11kv and below	1.40m
33kv and below	3.60m
132kv and below	4.70m
220kv and below	5.70m
400kv and below	6.50m

(b) If it becomes necessary to operate the machinery with clearances less than those specified in (a), it shall be ensured that the overhead power lines are invariably shut off during the period of operating of the machinery. Location of any underground power cables in the area of operation shall also be ascertained and necessary safety precautions taken.

(c) Wherever cranes are used for erection, the same shall be set on firm foundations. The outriggers of the cranes shall be used wherever available. The wheels shall be locked in position to prevent dislocation during handling. While working with cranes it is necessary that 'Load' to be lifted or moved does not cross 'tipping load' of crane for boom length and radius at which operation is being performed.

2.13 Suitable tie ropes shall be used to maintain control of tower sections being raised and positioned wherever possible and proper care shall be taken to see that they do not create any hazard. The wire rope used for carrying the section shall not be detached before the section is adequately secured.

2.14 The erection or maintenance work shall not be carried out during high wind, thunderstorms and heavy rainfall, which would make the work hazardous, except during emergency restoration procedure.

2.15 The designated officer shall keep maintained all the equipment, tools and plant in safe operating conditions.

2.16 Adequate traffic control shall be maintained wherever erection work is being carried out at highway crossings. The permissions required from the concerned authorities, such as department of highway, police etc., shall be obtained before commencement of work. Similarly, for erection work at railway crossing, the permission / Railway block shall be obtained from railway authorities before commencing the work.

2.17 The designated officer shall ensure the required clearance to be maintained while equipment moving under or near the energized