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**ELECTRICITY SAFETY REGULATIONS**

**ADOPTED BY**

**THE REGULATORY BOARD**

**OF**

**RWANDA UTILITIES REGULATORY AUTHORITY - (RURA)**

**NUMBER .../ENERGY/EL/RURA/2013**

**OF 25<sup>TH</sup> JULY 2013**

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## **PREAMBLE**

Pursuant to Law n°09/2013 of 01/03/2013 establishing the Rwanda Utilities Regulatory Authority;

Pursuant to Organic Law n° 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of the environment in Rwanda;

Pursuant to Law n°21/2011 of 23/06/2011 governing Electricity in Rwanda;

The Regulatory Board of the Rwanda Utilities Regulatory Authority in exercising its powers;

**AND AFTER** its deliberations in its meeting of 25<sup>th</sup> July 2013 ;

**HEREBY** issues the following regulations on Electricity Safety:

### **1. PREFACE**

#### **1.1. Citation**

These Regulations may be cited as the Electricity Safety Regulations, 2013.

#### **1.2. Application**

- (1) These Regulations apply to electrical systems, associated plants and apparatus under their ownership or control.
- (2) Documents or procedures issued by other authorities or licensees may apply in accordance with management instructions, but where no such rules, documents or procedures have been issued or if there is any conflict between such rules documents or procedures with these Regulations, these Regulations shall prevail.

#### **1.3. Interpretation**

In these Regulations, unless the context otherwise requires-

**“Additional earth”** means grounding equipment of an approved type, applied regarding the safety issues;

**“Apparatus”** means any item of electrical machinery or equipment in which conductors are used or supported or of which they form part;

**“Approved ...”** means in compliance with appropriate standards or in accordance with related documents issued by the Licensee or any other relevant institution;

**“Authority”** means the Rwanda Utilities Regulatory Authority, established under Law N°09/2013 of 01/03/2013;

**“Authorized person”** means a person appointed by the licensee in writing to carry out specified operational duties, including the issue of all types of safety documents;

**“Caution Notice”** A notice in an approved form attached to electrical apparatus or its controls conveying a warning against interference with such apparatus. These notices shall be attached to all points of isolation from which apparatus can be made live;

**“Circuit main earth”** means earthing equipment of an approved type, applied before the issue of, and at a position recorded in a safety document;

**“Conductor”** means a material, usually in the form of a wire, cable, bus bar or other metallic object suitable for carrying an electric current;

**“Competent person”** means a person appointed by a licensee in writing as having sufficient technical knowledge or experience to enable him or her avoid danger and who may be nominated to receive and clear specified safety documents;

**“Control operator”** means an operator mandated to operate computer controlled equipment;

**“Danger”** means a risk to health, life or bodily injury.

**“Danger Notice”** means a notice in an approved form reading 'danger' with any additional wording calling attention to the danger of approaching or interfering with such live apparatus;

**“Dead”** means at or about zero potential and disconnected from any live system;

**“Designated engineer”** means an engineer appointed by a licensee to be responsible for safety and application of these Regulations;

**“Earth”** means the conductive mass of the earth, whose electric potential at any point is conventionally taken as zero;

**“Earthed”** means connected to the general mass of earth in such a manner as will ensure at all times that the body being earthed discharges immediately any electrical energy stored in it and furthermore is maintained at a safe potential with respect to the general mass of earth;

**HV (High Voltage)** means voltage of the amount equal or above seventy thousand volts ( 70kV) plus or minus ten per cent;

**“Isolated”** means disconnected from live apparatus and conductors by an open disconnect or by an adequate physical gap;

**“Isolating device”** means a device for rendering plant and apparatus isolated;

**“key-safe”** means an approved device for the secure retention of all safety padlock keys used to lock means of isolation, earthing or other safety devices in accordance with these regulations;

**“live”** means electrically charged;

**“Live Line Work”** means working on live overhead exposed conductors and other apparatus using approved insulated tools and methods;

**“Licensee”** means a person authorized by a license or permit to generate, transmit, import, export distribute and/or supply electrical energy;

**“Limitation of access”** means a safety document that defines the limits and nature of work that may be carried out when verbal instructions are not considered sufficient for that purpose;

**LV ( Low Voltage)** means voltage less or equal to four hundred volts ( 400 V) plus or minus five percentages;

**MV (Medium Voltage)** means voltage above four hundred volts (400V) plus or minus ten percent and less or equal to thirty three thousand volts plus or minus ten percent;

**“Permit to work”** means a form of declaration signed and issued by the custodian of equipment or plant to the person in charge of a working party, giving clearance to work on the specified equipment or plant, detailing restrictions and precautions required to carry out the specified work safely;

**“Personal supervision”** means supervision by a person having adequate technical knowledge, experience or competence such that he or she is always in the presence of the person being supervised while the work or testing is being carried out;

**“Plant”** means a mechanical plant including all machinery and equipment not elsewhere defined as apparatus;

**“Safety distance”** means the distance from the nearest HV or MV exposed conductor not earthed, or from an insulator, supporting a HV or MV conductor which must be maintained to avoid danger;

**“Safety document”** means a limitation of access or permit-to-work;

**“Safety lock”** means a device such as a padlock used exclusively for approved purposes, like locking off the points at which the circuit can be energized, and different from all other standard locks used in systems;

**“Senior competent person”** means a competent person appointed in writing by a licensee, to carry out specific operational duties that may include authority to issue and cancel limitations-of-access or to receive sanctions-for-test;

**“Switching”** means the operation of circuit breakers, isolators, fuses or other methods of making or breaking an electrical circuit or the application and removal of circuit main earths;

**“System”** means an electrical system in which conductors and apparatus are electrically connected to a common source of supply;

**“System control engineer”** means-

(a) For the centrally controlled system, the Control Engineer at the National Control Centre; and

(b) For a locally controlled system, the engineer specifically mandated to exercise the function and control of such a system;

**“Working and access clearance”** means the distance to be maintained from the nearest live exposed HV or MV conductor, to ensure observance of the safety distance in work on systems;

**“Working party”** means persons under the immediate supervision of a competent or senior competent person (who shall himself or herself be a member of the working party) or a competent or senior competent person when working alone.

## **2. GENERAL PROVISIONS**

### **2.1. Information and instruction**

(1) Each licensee shall sufficiently inform and instruct its employees about the system, plant or apparatus affected by a particular operation or work, and the rules, procedures or documents which apply to such licensee's operations.

(3) A licensee shall in addition to sub-regulation (1), furnish information to other persons not being its employees who are likely to be exposed to danger by the operations or work of such licensee, to such an extent as may in the licensee's opinion be reasonably practicable.

### **2.2. Variation**

The Authority may in exceptional or special circumstances vary these Regulations and issue additional guidelines to such an extent as may, in the opinion of the Authority, be necessary to achieve the objectives of these Regulations.

### **2.3. Special procedures**

A licensee shall ensure that work on or testing of apparatus, conductors or plant to which these Regulations are, for special reasons, not applicable, shall be carried out according to a special procedure which shall adhere to the safety requirements prescribed under these Regulations.

### **2.4. Objections**

(1) A person who receives instructions regarding the operation of or work upon a licensee's systems and associated plant and apparatus shall, if he or she has an objection on safety grounds against the carrying out of such instructions, lodge such objection with the person issuing the instructions.

(2) Where an objection has been raised under sub-regulation (1), the licensee or other concerned entity shall cause investigations to be conducted into the merits of the objection and if necessary refer the matter to a higher authority for a decision before proceeding with such operation or work.

### **2.5. Accidents and dangerous occurrences**

(1) Every electrical accident and dangerous occurrence involving a licensee's HV or MV system shall be reported immediately to the branch/site engineer and reserve a copy to the Authority.

(2) Each accident and dangerous occurrence involving a LV system or associated plant or apparatus shall be reported immediately to the appropriate designated Engineer.

### **2.6. Duties**

(1) A person engaged in the operations or work upon electrical systems and associated plant and apparatus shall comply with these Regulations and other related documents and legal procedures relevant to his or her duties.

(2) A person shall not neglect his or her duties on ground that he or she is ignorant of the relevant legal requirements and procedures.

(3) A person who has any doubts as to any of these duties shall report the matter to his superior(s) for advice before proceeding with the work.

## **2.7. Safety equipment and protective clothing**

(1) Every licensee shall obtain and issue to its employees safety equipments and protective clothing.

(2) Each employee working under circumstances requiring safety precautions shall wear appropriate protective clothing and foot wear or such other protective clothing as may be necessary, having considered the work such employee may be involved in.

## **2.8. Electric shock**

Every licensee shall train each person involved with the operation of or work upon the licensee's system and associated plant and apparatus, in the treatment of electric shock.

# **3. GENERAL SAFETY PRECAUTIONS**

## **3.1. Access to and work in operational premises**

(1) A person shall not without authorization, enter or have access to any operational premises like a control room, substation, switching station or underground chamber belonging to or under the control of a licensee.

(2) A barrier, door or gate restricting access to an underground chamber or other confined space, substation or tunnel shall be kept locked and the control of the keys shall be in accordance with licensee approved procedures.

(3) A person shall not enter or work in any indoor substation or confined space such as an underground chamber, tunnel, vessel, tank, pit, culvert or pipeline without the consent of a senior competent person.

(4) Where it becomes necessary for a person to enter and work in any of the places specified under sub-regulation (3), adequate precautions shall be taken against danger arising from toxic and flammable or abnormal temperature.

(5) Safety precautions under sub-regulation (4) include but are not limited to-

(a) Use of approved natural or forced ventilation or air conditioning;

(b) Wearing approved breathing apparatus;

(c) Testing the atmosphere using approved specialized equipment;

(d) Prohibition of smoking and use of exposed flame; and

(e) Posting a person outside such place to keep in constant touch with the person engaged in the work with appropriate rescue equipment, ready and capable of assisting in an emergency.



- (6) A person using the apparatus under paragraph (b) of sub-regulation (5) shall be specifically trained in its use.
- (7) Before a person enters an area under this regulation, he or she shall be issued with a limitation-of-access, and the arrangements for access and work and the precautions to be taken shall be in accordance with the licensee approved procedures.

### **3.2. Vessel containing flammable substance**

- (1) A person shall not smoke or expose a flame near an open vessel containing or which has contained oil or any other flammable substance.
- (2) A person shall not engage in work involving application of heat on a vessel under sub-regulation (1) unless such person has taken all practical precautions to prevent a fire or explosion. The prevention of fire or explosion shall be done by removal of the flammable substance and any fumes or by rendering them non explosive and non flammable.
- (3) A person shall not enter a vessel that has recently been emptied of oil or other flammable or toxic substance unless a senior competent person is satisfied that all dangerous vapours have been expelled, and a limitation-of-access has been issued.

### **3.3. Work in fire protected areas**

- (1) Unless alternative approved safety procedures apply because of special circumstances, before access or work is carried out in an enclosure protected by automatic fire extinguishing equipment:
  - (a) The automatic control shall be rendered in-operative and the equipment left on manual control, and a caution notice attached;
  - (b) The precautions taken to render the automatic control in-operative and the conditions under which it may be restored shall be noted on a safety document or written instruction issued for such access or work or other activity; and
  - (c) The automatic control shall be restored immediately after the persons engaged in the work have withdrawn from the enclosure.
- (2) Only approved portable fire extinguishers shall be made available and shall be the only extinguishers to be used near live apparatus and conductors.
- (3) In the handling of fire extinguishers, the safety distances specified in the manual or safety procedures shall be maintained.
- (4) After the discharge of a portable fire extinguisher in an enclosed space, personnel shall leave the space until the precautions specified in regulation 3.2(3) have been taken.
- (5) After an explosion, fire or discharge of a fire extinguisher in an enclosed space, the space shall be adequately ventilated before any personnel enter it.

### **3.4. Work on poles, towers and high structures.**

- (1) A person shall not climb any pole unless such a pole has been tested in a licensee approved manner.
- (2) A person shall not climb a pole which is impaired by decay or damage or whose stability is in doubt until such pole has been supported by approved means.
- (3) Where a pole is supported as provided under sub-regulation (2), such pole shall be climbed by one person at a time or access to its top may be by other approved means independent of the pole.
- (4) A person gaining access to work on a tower, pole or other high structure shall use safety belts, harnesses or other safety equipment of an approved type.
- (5) A person working on a tower, pole or other high structure shall be in visual range of another person who shall be fully conversant with approved rescue procedures.
- (6) Every gate or device to prevent climbing of towers and gantries supporting HV or MV conductors shall always be kept secured in an approved manner, and access shall be controlled by a competent person.

### **3.5. Access to HV or MV apparatus and conductors**

- (1) Guards to an access ladder, barrier, door or gate on or in an outdoor compound preventing access to a live HV or MV conductor shall be kept secured in an approved manner, and access to them shall be according to approved procedure.
- (2) Any barrier, door or gate preventing access to a totally enclosed chamber, cubicle or cell containing live HV or MV conductors shall be kept locked and the keys shall be accessible only to a senior competent person.
- (3) Any spout shutter not required for immediate work or operation shall, if the spout is not otherwise made inaccessible, be locked and the key accessible only to a senior competent person.

### **3.6. HV or MV switching**

- (1) HV or MV switching shall not be carried out by any person other than an authorized person, a senior competent person or by remote control directed by a control engineer.
- (2) Notwithstanding sub-regulation (1), a competent person may for the purpose of training and acting under the personal supervision of an authorized person or senior competent person, carry out HV or MV switching.
- (3) Except in cases of emergency, HV or MV switching shall not be carried out without the permission of the appropriate branch/ site engineer.
- (4) When a control engineer gives permission for HV or MV switching to be carried out, he or she shall communicate directly with the person intending to carry out the switching, and where for special reasons direct communication is not possible, an approved procedure shall be followed.

- (5) Before any HV or MV switching is carried out on any system that may affect another system, the control engineer authorizing the switching shall communicate with the control engineer of the other system and the switching shall be agreed between them and recorded in the respective control books of all control engineers concerned.
- (6) Where there are special requirements to be complied with before, during or after HV or MV switching operations, approved procedures shall apply and special provisions shall be made to ensure that the control engineers, the operators and others affected are aware of their responsibilities.
- (7) HV or MV switching with the control engineer's permission shall be carried out without undue delay and all such switching or switching in emergency, shall be reported to the control engineer as soon as possible. For emergency switching, the circumstances demanding such switching shall be reported at the same time.
- (8) If switchgear shows any sign of distress, the operator shall report its condition to the control engineer who shall in turn report to a senior in order to have it examined before taking a decision about further operation.
- (9) An operator shall, while operating a switching gear mounted on a pole or other structure from ground level where necessary, wear rubber gloves or use other appropriate equipment.
- (10) A person shall not undertake switching or work on HV or MV equipment by signal or prearranged understanding after an agreed interval of time.

### **3.7. Records**

- (1) Every message by telephone or otherwise relating to the operation of a HV or MV system shall be recorded down and shall be repeated to the sender to ensure that it has been accurately received.
- (2) A control engineer shall ensure that a record is made of the time and particulars of all HV or MV switching including that carried out by the control engineer by remote control.

### **3.8. Failure of supply**

- (1) A failure of supply to or from any part of a HV or MV system from whatever cause, shall be immediately reported to the control engineer and give a copy to the Authority.
- (2) During a failure of supply, all apparatuses and conductors are regarded as live unless they are isolated and proved dead by approved means.

### **3.9. Voltage testing devices**

- (1) Voltage testing devices shall be of an approved type and shall be used in accordance with approved procedures.
- (2) Voltage testing devices shall be tested in an approved manner immediately before and after use, and where this is not practically possible, in accordance with other approved procedures.

#### **4. SAFETY PECAUTIONS FOR WORK ON OR NEAR HV OR MV SYSTEMS**

##### **4.1. General requirements**

- (1) Subject to the exceptions specified in this regulation and those expressly allowed by individual rules, a person shall not undertake any repair, maintenance, cleaning, alteration or such work, on or within the safety distance of an exposed conductor, part of a HV or MV system distance of an exposed conductor or part of a HV or MV system unless such parts of the system are-
  - (a) Dead;
  - (b) Isolated and all practicable steps taken up to lock off from all points of supply, including voltage and auxiliary transformers, common earthing equipment and other sources from which the apparatus and conductors may become live with caution notices fixed at all points of isolation;
  - (c) Earthed by approved means at all points of disconnection of HV or MV supply from the system or between such points and the point of work;
  - (d) Screened where necessary to prevent danger, and danger notices are attached to apparatus containing live conductors and attached near other live conductors;
  - (e) Identified at the point of work by approved means;
  - (f) Released for work by the issue of an appropriate safety document that shall not be issued unless such person is fully conversant with the precise parts of the systems, apparatus and conductors to be worked upon, the nature and extent of the work to be done and the safety precautions to be taken.
- (2) It is the duty of the person issuing the appropriate safety documents to ensure compliance with the provisions of sub-regulation (1).
- (3) Notwithstanding the provisions of sub-regulation (1)-
  - (a) Work such as cleaning and painting of earthed metal enclosures, connections or disconnections of circuits to or from live HV or MV systems, live line testing and live insulator washing may be carried out but only according to the licensee approved procedures;
  - (b) As a safeguard for personnel carrying out cleaning and painting works on substations, the system diagram in the appropriate local office shall be marked to show the work locations;
  - (c) HV or MV live line work on HV or MV overhead lines may be carried out but only according to the appropriate procedures;
  - (d) Where the design of apparatus does not allow strict compliance with all the requirements in that sub-regulation and if an operational procedure for carrying out the work does not exist, the work shall be carried out in accordance with special instructions issued by an authorized person, to ensure that safety is achieved, and shall be carried out under the

personal supervision of the authorized person, with the control engineer kept informed of the circumstances.

#### **4.2. Isolation of apparatus and conductors**

- (1) Safety locks shall be used to lock all switch gear at points where the circuit on which work is to be carried out is likely to be energized and the keys for such locks shall be kept in a key safe, if provided, or in some other safe place in the possession of an authorized person.
- (2) Safety locks shall be fitted to the switch gear at all points of isolation immediately following the sectionalization of defective apparatus.
- (3) Details of the isolation referred to in sub-regulation (1) and the deposit of safety lock keys associated with the isolation shall be recorded by the Control Engineer.
- (4) Where the circuit on which work is to be carried out is controlled only by fuses or links, the fuses or links (and carriers) shall be removed and kept in a safe place preferably in the possession of the person responsible for issuing the safety documents, or where such removals are not practicable approved procedures to ensure safety shall be followed.
- (5) When the mechanical isolation of a voltage transformer involves physical difficulty in withdrawal to achieve total HV or MV isolation, the withdrawal of the voltage transformer secondary fuses or links may be accepted as isolation, and fuses or links so withdrawn shall be kept in a safe place in the possession of the person responsible for issuing the safety document, and caution notices shall be fixed at all points of isolation.

#### **4.3. Earthing**

- (1) Where HV or MV apparatus or conductors are to be discharged and earthed in accordance with regulation 4.1(1), it shall be done-
  - (a) When reasonably practicable, by using a circuit breaker or earthing switch provided for the purpose of making the earthing connection, and where a circuit breaker is used the trip feature shall be rendered inoperative before closing unless this is not practicable when it shall be done afterwards. After closing, the circuit breaker or earthing switch shall be locked in the earthed position, so that it remains inoperative while it is the circuit main earth;
  - (b) Where a circuit breaker is used to make the earth connection, the operation of closing to earth shall be carried out locally and Supervisory Control and Data Acquisition (SCADA) system shall not be used for this purpose;
  - (c) Where paragraph (a) is not reasonably practicable or not applicable, the HV or MV apparatus and conductors shall be checked by means of an appropriate testing device to verify that they are not live, and may then be discharged and earthed by an earthing lead applied by means of an approved earthing appliance;
  - (d) Where work is carried out on an overhead system to which a consumer remains connected, a circuit main earth shall be provided and maintained between that consumer and the point of work;

- (e) Due to the possibility of LV and HV or MV inversions like from customers generation, care shall be taken when using earthing lead following a test with the indicator, to verify that the circuit is not live, and one conductor shall be earthed and subsequent tests carried out to verify that the retaining conductors are not live before applying an earth to them.
- (2) Earthing leads and associated clamps shall be of an approved type and of adequate capacity for the duty at the point of application, and shall be adequately maintained and always examined immediately before use.
- (3) Subject to sub-regulation (1), the general procedure to be followed when using earthing leads shall be as follows-
- (a) The circuit shall be verified that it is not live and where practicable, checked by means of an appropriate voltage testing device or other approved means;
- (b) The circuit shall be verified that it is not live and, where practicable, checked by means of an approved earthing pole or other approved appliance and care shall be taken to ensure that good contact is made and that earthing leads are clearly visible;
- (c) Earthing leads shall be connected to earth before being connected to the phase conductors. They shall only be connected to the phases by means of an approved earthing pole or other approved appliance. Care shall be taken to ensure that good contact is made and that earthing leads are clearly visible;
- (d) All phases shall be earthed, even if work is to be carried out only on one phase;
- (e) Earthing leads shall not be applied in any cell or compartment in which there is any exposed metal live at HV or MV that may be a source of danger, and shall be applied so that they remain clearly visible as far as it is reasonably practicable;
- (f) When earthing leads are being removed, each shall be disconnected from its phase conductor by means of an approved earthing appliance before it is removed from its earth connection;
- (g) For earthing on spout contacts of metal-enclosed switchgear, only approved appliances shall be used and a person shall not insert a hand or tool into contact with spouts for this purpose.
- (4) A person shall not operate a HV or MV earthing switch or circuit main earth connected or disconnected, except with the consent of the Control Engineer or a senior competent person.
- (5) The location of each circuit main earth shall be recorded on the safety document.

#### **4.4. Approach to exposed live HV or MV conductors or supporting insulators**

- (1) A person shall not allow any part of his or her body or any other object not provided for within the approved procedures to approach exposed HV or MV conductors or insulators supporting such conductors, unless the conductors have been made safe for work and a safety document issued as required by sub-regulation (1) of regulation 4.1. Unless it is unavoidable, such

person's hands shall be kept below shoulder height when in the vicinity of exposed live HV or MV conductors.

- (2) When a person is applying an appropriate voltage testing device to HV or MV conductors contained within the open spouts of metal enclosed switch gear, it is allowable for those parts of the body of such person required to do the task to approach the conductors, subject to approved procedures.
- (3) Where exposed HV or MV conductors are not isolated but not proved dead, the only objects that shall be caused to approach them or insulators supporting them shall be insulated devices approved for HV or MV live line work or approved voltage testing devices.
- (4) Where exposed conductors in a HV or MV substation compound have been isolated, a circuit main earth may be applied to the apparatus following a visual examination to confirm that adequate isolation has been achieved.
- (5) Taking account of the nature and location of the work and the hazards and the presence of persons, a senior competent person shall establish working and access clearances such as to ensure that the safety distances are maintained both in respect of those persons present and the objects being handled.
- (6) Recommended working and access clearances for the guidance of authorized persons are specified in the standards RS 474-1: 2011 for Power Installations exceeding 1kV a.c.
- (7) Where work is to be carried out within a one meter distance of an HV or MV conductors or apparatus the supervisor shall ascertain if any of the following additional precautions have been taken before work commences-
  - (a) A visible danger notices or red pennants are attached to the pole, structure or apparatus
  - (b) A limitation-of-access has been issued defining the work to be carried out in the vicinity of live conductors and detailing any specified potential hazards to be avoided.
  - (c) Danger notices or red pennants shall be attached by a senior competent person or engineer or by a competent person acting under personal supervision of an authorized person or senior competent person.

#### **4.5. Work in substations and switching stations containing exposed live HV or MV conductors**

- (1) The following provisions apply to a zone of work:
  - (a) When work is to be carried out in a substation, or switching station in which there are exposed live HV or MV conductors, the zone of work shall be properly identified by an authorized person, and shall be defined as far as possible by the use of approved barriers roping, yellow demarcation ribbons or by other approved means and shall be so arranged that the specified working and access clearances, from the nearest exposed live conductor or supporting insulator to ground level or platform or access way which may be repaired to be used, are established;

- (b) The zone of work to be defined at ground level shall be only that in which the work is to be carried out;
  - (c) If the work cannot be carried out without leaving the ground level or a platform or access way, the working and access clearances shall be obtained from the nearest exposed live HV or MV conductor to the points from which work is actually carried out, and in such cases access shall only be by means of an approved ladder or other approved means;
  - (d) A person shall not climb any structure to gain access. In the case of terminal poles in substations, access shall be in accordance with approved procedures;
  - (e) If the work is such that the specified working and access clearances are not sufficient to avoid danger, other suitable arrangements shall be made; and
  - (f) The approved barriers or roping shall be clearly visible, so far as it is reasonably practicable, and shall not be supported by any structure carrying electrical apparatus or conductor and shall not carry any notice; and at ground level the section so defined shall be clearly distinguished by green flags by day or, if not otherwise satisfactorily illuminated, by green lights at night, fixed on separate supports and suitably spaced within the safe boundary. Danger notices shall be attached to adjoining apparatus containing live conductors or adjacent conductor supports at the limits of the zone of work.
- (2) Where necessary to prevent danger, the means of access to and from the zone of work shall be defined in an approved manner.
- (3) The working and access clearance required at the zone of work under sub-regulation (1) shall be specified in the safety procedures;
- (4) The following provisions apply to the use of portable ladders and long objects where there are exposed live conductors-
- (a) The type of portable ladders shall be approved and shall be of no greater length than is required for the work involved;
  - (b) Portable ladders and other long objects shall not be used without the permission of an authorized person, who shall define the conditions of use to the senior competent person in charge of the work, the movement and erection of such ladders and objects shall then be carried out only under the personal supervision of the senior competent person in charge of the work, and when moved at ground level shall be carried only in a horizontal position and as near the ground as reasonably practicable;
  - (c) Portable ladders provided for giving access to fixed ladders which terminate above ground level, and to provide access in other approved cases, shall be padlocked in position or otherwise secured by a senior competent person while work is being carried out; and
  - (d) All portable ladders within substations or switching stations shall be securely locked to a suitable anchorage when not in use.
- (5) The following provisions apply to the use of cranes, scaffolds and other equipment-



- (a) when cranes, scaffolds or other equipment and materials transported by vehicles or otherwise are taken into or out of a substation, the route to be followed shall be agreed by an authorised person, and the cranes scaffolds or other equipment shall be connected to the substation earthing system as soon as reasonably practicable;
  - (b) The limits of operation of such equipment shall be defined by an authorized person to a senior competent person who shall be in charge of the work and thereafter the equipment shall be erected or moved only within such limits under the personal supervision of the senior competent person.
- (6) Danger notices, barriers and screens shall be fixed or moved only by, or under the personal supervision of an authorized person.
- (7) In the event of a lightning storm, work on exposed conductors in outdoor substations or outdoor switching stations, or on apparatus directly connected to exposed conductors shall cease immediately where necessary, to prevent danger and the control engineer shall be informed.

## **5. SAFETY PRECAUTIONS AND PROCEDURE APPLICABLE TO LV SYSTEMS**

### **5.1. General**

- (1) Where work or testing is carried out on or near LV apparatus and conductors-
- (a) Precautions shall be taken to prevent danger from body injury due to electric arc or electric shock;
  - (b) The conductors shall be covered with insulation and screening, and the adequacy of these materials to prevent danger shall be assessed before work or testing is carried out; and
  - (c) The precautions appropriate to work on or near exposed danger precautions appropriate to work on or near exposed conductors shall be applied.
- (2) Danger may arise in the following circumstances-
- (a) Where a person confuses apparatus and conductors which have been made dead with those which remain live;
  - (b) Dead apparatus and conductors are accidentally or inadvertently made live;
  - (c) If a person accidentally or inadvertently makes contact with adjacent live conductors; or
  - (d) If inadequate precautions are taken during live work or testing.
- (3) Control and operation of LV systems shall be in accordance with an approved procedure, and only persons appointed in accordance with an approved procedure shall carry out activities such as switching and the live testing of LV systems.

- (4) Work or testing of LV apparatus and conductors shall be carried out by a competent person, and where working arrangements so require, approved procedures for the control of work, including the issue of a safety document shall apply.
- (5) Where work or testing involves the initial connection or the rearrangement of conductors to a consumer, the electricity supply shall not be provided to the consumer until checks have been made at an appropriate point on the system to ensure correct polarity at the supply terminals and where necessary, in the case of a three-phase supply, the phase rotation shall additionally be checked.
- (6) A person shall not erect or dismantle a LV overhead line under a live HV or MV overhead line without the permission of an authorized person, who shall ensure that when necessary because of insufficient clearance, the HV or MV line is made dead and a permit-to-work issued.
- (7) When a LV overhead line conductor is to be raised or lowered or otherwise held on temporary support or connections, approved procedures shall be followed to ensure that no danger is caused at locations such as road or rail crossing where other persons may be present.

## **5.2. Requirements for work on dead LV apparatus and conductors**

- (1) When work is to be carried out on dead LV apparatus:
  - (a) The conductors shall be isolated from all sources of supply from the system,
  - (b) Where the isolating devices are lockable, safety locks shall be applied,
  - (c) If components such as fuses and links are removable, they shall be removed,
  - (d) Caution notices shall be securely fixed at all points of isolation and
  - (e) Keys and removed components shall be kept in a secure place in the possession of the person in charge of the work.
- (2) Conductors shall be earthed using an earthing device or earthing leads approved for use on the conductors concerned.
- (3) Except when work on a LV system is being carried out as part of approved HV or MV live line work, the following requirements shall apply:
  - (a) If the work requires a point of isolation to be established on a HV or MV system, an appropriate safety document shall be issued,
  - (b) If the work requires a HV or MV system to be made dead, isolated and earthed, an authorization of a senior competent person shall be issued and
  - (c) If the work is being done in conjunction with work on a HV or MV system which has been made dead, isolated and earthed, this work shall be included the authorization for the HV or MV work issued by a senior competent person.

- (4) Suitable precautions shall be taken by approved screening or other approved means to avoid danger from inadvertent contact with adjacent live conductors including where necessary, the fixing of danger notices to apparatus containing live conductors adjacent to other live conductors and at the limits of the zone in which the work may be carried out.
- (5) Where conductors are likely to become live due to the operation of a consumer's generator, the following precautions shall be taken to prevent danger:
  - (a) The conductors shall be isolated from the consumer's system or
  - (b) The conductors shall be earthed on an earth provided between the point of work and the consumer's system.
- (6) Before work is connected, the apparatus and conductors shall be identified and proved dead at the point of work by means of an approved voltage testing device, and whilst work is in progress, any live working method that can reasonably be applied to minimize the risk of danger from the conductors being accidentally or inadvertently made live shall be used.

### **5.3. Precautions for work on dead LV cables**

- (1) A cable to be worked on shall be identified in accordance with the following-
  - (a) Unless the point of work can be visually traced from a point where the conductors are accessible and have been proved dead at that point, it will be necessary to open the cable as if it is live and test each conductor with an approved voltage testing device; and
  - (b) If the cable has been damaged or is faulty, it shall not be presumed dead, and consequently, the test shall be made at a safe distance from the suspected point of damaged fault and the cable shall be visually traced from the point of test to the suspect point of damage or fault. Appropriate precautions shall be taken to avoid danger from electric arcing until the point of damage or fault is located.
- (2) Where work is to be carried out on an auxiliary cable which may be subject to induced voltage from a HV or MV circuit, additional precautions to prevent danger from these voltages shall be taken in accordance with approved procedures.

### **5.4. Precautions for work on dead LV overhead lines**

- (1) Bare open-wire LV conductors shall be earthed using approved earthing leads, and where insulated but unscreened conductors are present, the requirements for live working shall be observed until the conductors have been proved dead.
- (2) Any unearthed steelwork such as an offset racket or the upper portion of a stay above the insulator shall be treated as live until it is or the conductors have been proved dead.

### **5.5. Work on live LV apparatus and conductors**

- (1) A person shall not carry out LV live work except in accordance with an approved procedure, which shall ensure adequate protection from danger from electric shock and inadvertent short-circuiting of the conductors.

- (2) Where LV live work is to be carried out, the competent person in charge of the working party shall make an assessment of the site conductors, and the work shall only commence where site conditions enable work to be done safely.
- (3) If the site conditions become unsafe, LV live working shall be suspended and the following requirements shall be assessed:
  - (a) The apparatus to be worked upon shall be visually inspected to ascertain if it is in a satisfactory condition;
  - (b) There shall be adequate working space and safe means of escape;
  - (c) The working space and the apparatus to be worked on shall be adequately illuminated; and
  - (d) If the work is outdoors, the weather conditions shall not be unduly adverse.
- (4) Every person who carries out live working shall be a competent person and shall have received appropriate training in the particular LV live working procedure, and adequately instructed by the competent person in charge of the working party.
- (5) Tools and equipment approved for that purpose shall be the only tools used for work on, or the testing of LV apparatus and conductors.
- (6) A person shall not carry out work which involves, or is equivalent to a manipulation of bare live conductors unless accompanied by another person who shall be available to render or obtain assistance in an emergency.

#### **5.6. Precautions for work on live LV cables**

- (1) A cable to be worked on shall be identified by approved means, and all metal work adjacent to the point of work shall be adequately shrouded with approved insulating material to prevent inadvertent contact. The metallic sheaths of cables shall be bonded to each other with an approved insulated conductor before jointing and cutting to ensure continuity of the electrical circuit through the sheath.
- (2) Unless alternative approved procedures allow, during all work including the change of cut-outs, only one conductor shall be bared at a time and insulating gloves and an insulating mat shall be used.

#### **5.7. Precautions for work on live LV overhead lines**

- (1) Where work is carried out on live overhead lines, any unearthed steelwork such as an offset bracket shall be proved dead using an approved voltage testing device.
- (2) When work is carried out on insulated but un-screened LV conductors, a person working on such conductors shall use appropriate insulating tools provided in the sub-regulation 2.7.(2) to prevent danger that may arise if the insulation has deteriorated or is damaged.

## **5.8. Application of HV or MV rules to work on LV apparatus and conductors**

Safety regulations applicable to work on HV or MV systems, apparatus and conductors may, with the necessary modifications, be applied to work on LV systems, apparatus and conductors in accordance with approved procedures.

## **5.9. Testing and adjustment of LV apparatus**

- (1) Testing and adjustment including functional testing may be made with LV apparatus live if a person making such testing and adjustment uses approved insulated tools and instruments.
- (2) If the testing or adjustment requires covers to be removed so that terminals or connections that are live or can be made live are exposed or temporarily disconnected, precautions shall be taken to prevent unauthorized access to or interference with the apparatus. Such precautions shall include where necessary, personal supervision or erection of suitable barriers or screening and the display of danger notices.
- (3) If the conductors are to be made dead in order to avoid danger, appropriate requirements under regulations 5.2 and 5.3 shall be applied.

## **6. FINAL PROVISIONS**

### **6.1. Inspection**

The Authority is responsible for carrying out inspections to ensure compliance with these regulations.

### **6.2. General penalty**

A person who contravenes the provisions of these Regulations commits an offence and is liable on conviction to a fine not exceeding 1,000,000 RWF.

### **6.3. Repealing provision**

All prior provisions contrary to these regulations are hereby repealed

### **6.4. Coming into force**

These regulations shall come into force on the date of approval and signature by the Regulatory Board.

**Kigali, on the 25<sup>th</sup> July 2013**

**Eugène KAZIGE**

**CHAIRMAN OF THE REGULATORY BOARD**