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George K. Burgess, Director

**SAFETY RULES FOR
THE OPERATION OF ELECTRICAL
EQUIPMENT AND LINES**

HANDBOOK OF THE BUREAU OF STANDARDS, No. 8

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BUREAU OF STANDARDS

George K. Burgess, Director

HANDBOOK SERIES OF THE BUREAU OF STANDARDS, No. 8

**SAFETY RULES FOR
THE OPERATION OF ELECTRICAL
EQUIPMENT AND LINES**

**COMPRISING PART 4 OF THE FOURTH EDITION
NATIONAL ELECTRICAL SAFETY CODE**

JULY 15, 1926



PRICE 15 CENTS

Sold only by the Superintendent of Documents, Government Printing Office
Washington, D. C.

**WASHINGTON
GOVERNMENT PRINTING OFFICE**

1926

PREFACE

Previous editions of the National Electrical Safety Code have been published in complete form. There has been some demand, however, for smaller handbooks containing a single part of the code and in response to this demand the fourth edition is being issued not only as a whole but also as separate publications dealing with the several subjects involved.

This volume contains part 4 dealing with rules for the operation of electrical equipment and lines. This part of the code was the first to be formulated and was originally published as B. S. Circular No. 49. It was later incorporated with other parts to form the first edition of the National Electrical Safety Code.

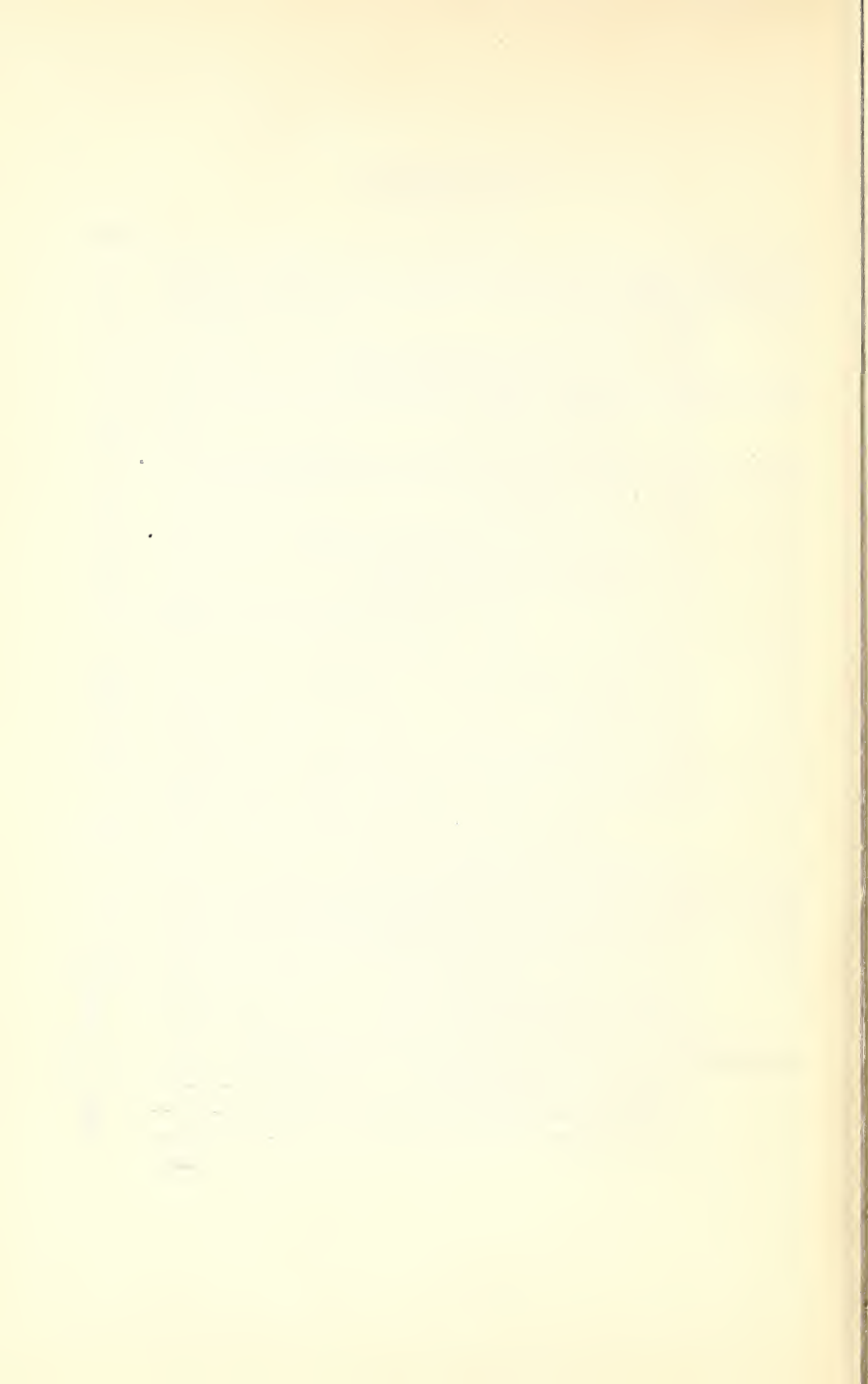
The present edition of these rules is the result of a revision which has been carried out according to the procedure of the American Engineering Standards Committee, and the revised rules have had the approval of a sectional committee organized in conformity with those rules of procedure. A discussion of these rules will be found in the revised edition of Handbook No. 4.

Criticism of the rules and suggestions for their improvement are invited, and in future editions every effort will be made to perfect the rules both in the development of detail and in the modification of any requirements which it is found can be improved.

GEORGE K. BURGESS,
Director.

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SAFETY RULES FOR THE OPERATION OF ELECTRICAL EQUIPMENT AND LINES

COMPRISING PART 4 OF THE FOURTH EDITION, NATIONAL
ELECTRICAL SAFETY CODE

DEFINITIONS

Alive or live means electrically connected to a source of potential difference, or electrically charged so as to have a potential different from that of the earth. The term "live" is sometimes used in place of the term "current carrying" where the intent is clear, to avoid repetitions of the longer term.

Circuit means a conductor or system of conductors through which an electric current is intended to flow.

Circuit-breaker means a device designed to open under abnormal conditions a current-carrying circuit without injury to itself. The term as used in this code applies only to the automatic type designed to trip on a predetermined overload of current.

Climbing space means the vertical space reserved along the side of a pole structure to permit ready access for linemen to equipment and conductors located on the pole structure.

Communication lines means the conductors and their supporting or containing structures which are located outside of buildings and are used for public or private signal or communication service and which operate at not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed

150 watts. When operating at less than 150 volts, no limit is placed on the capacity of the system.

Notes: Telephone, telegraph, messenger call, clock, fire or police alarm, and other systems conforming with the above are included.

Lines used for signaling purposes, but not included under the above definition, are considered as supply lines of the same voltage and are to be so run.

Exception is made under certain conditions for communication circuits used in the operation of supply lines.

Conductor means a metallic conducting material, usually in the form of a wire or cable, suitable for carrying an electric current. Does not include bus bars.

Conduit means (in interior and overhead work) a tube or duct especially constructed for the purpose of inclosing electrical conductors.

Current-carrying part means a part intended to be connected in an electric circuit to a source of voltage. Non-current-carrying parts are those not intended to be so connected.

Dead means free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of the earth. The term is used only with reference to current-carrying parts which are sometimes alive.

Disconnecter means a switch which is intended to open a circuit only after the load has been thrown off by some other means.

Note: Manual switches designed for opening loaded circuits are usually installed in circuit with disconnectors, to provide a safe means for opening the circuit under load.

Duct means (in underground work) a single tubular run-way for underground cables.

Electrical supply equipment means equipment which produces, modifies, regulates, controls, or safeguards a supply of electrical energy. Similar equipment, however, is not included where used in connection with signaling systems under the following conditions:

(a) Where the voltage does not exceed 150.

(b) Where the voltage is between 150 and 400, and the power transmitted does not exceed 3 kilowatts.

Electrical supply lines means those conductors and their necessary supporting or containing structures which are located entirely outside of buildings and are used for transmitting a supply of electrical energy.

Does not include open wiring on buildings, in yards, or similar locations where spans are less than 20 feet, and all the precautions required for stations or utilization equipment, as the case may be, are observed.

Railway signal lines of more than 400 volts to ground are always supply lines within the meaning of these rules, and of less than 400 volts may be considered as supply lines, if so run and operated throughout.

Electrical supply station means any building, room, or separate space within which electrical supply equipment is located and the interior of which is accessible, as a rule, only to properly qualified persons.

Note: This includes generating stations and substations and generator, storage-battery, and transformer rooms, but excludes manholes and isolated transformer vaults on private premises.

Exposed (applied to circuits or lines) means in such a position that in case of failure of supports or insulation contact with another circuit or line may result.

Exposed (applied to equipment) means that an object or device can be inadvertently touched or approached nearer

than a safe distance by any person. It is applied to objects not suitably guarded or isolated.

Grounded means connected to earth or to some extended conducting body which serves instead of the earth, whether the connection is intentional or accidental.

Grounded system means a system having a permanent and effective electrical connection to earth. This ground connection may be at one or more points.

Note: "Effective," as herein used, means a connection to earth of sufficiently low resistance and high current-carrying capacity to prevent any current in the ground wire from causing a harmful voltage to exist between the grounded conductors and neighboring exposed conducting surfaces which are in good contact with the earth, or with neighboring surfaces of the earth itself, under the most severe conditions which are liable to arise in practice.

Permanently grounded means having such an effective connection to the earth (by use of an underground system of metallic pipe mains or other suitable means), as described in the preceding paragraph.

Guarded means covered, shielded, fenced, inclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats or platforms, to remove the liability of dangerous contact or approach by persons or objects to a point of danger.

Handhole means an opening in an underground system into which workmen reach, but do not enter.

Insulated means separated from other conducting surfaces by a dielectric substance or air space permanently offering a high resistance to the passage of current and to disruptive discharge through the substance or space.

Note: When any object is said to be insulated, it is understood to be insulated in suitable manner for the condi-

tions to which it is subjected. Otherwise, it is, within the purpose of these rules, uninsulated. Insulating covering of conductors is one means for making the conductors insulated.

Insulating (where applied to the covering of a conductor, or to clothing, guards, rods, and other safety devices) means that a device, when interposed between a person and current-carrying parts protects the person making use of it against electric shock from the current-carrying parts with which the device is intended to be used; the opposite of conducting.

Lateral working space means the space reserved for working between conductor levels outside the climbing space, and to its right and left.

Line conductor means one of the wires or cables carrying electric current, supported by poles, towers, or other structures, but not including vertical or lateral connecting wires.

Manhole (more accurately termed splicing chamber or cable vault) means an opening in an underground system which workmen or others may enter for the purpose of installing cables, transformers, junction boxes, and other devices, and for making connections and tests.

Open wires means overhead wires not in conduits, and consisting of single or paired conductors as opposed to multiple-conductor cables.

Qualified means familiar with the construction and operation of the apparatus and the hazards involved.

Switch means a device for opening and closing or for changing the connection of a circuit. In these rules a switch will always be understood to be manually operated, unless otherwise stated.

Tags means "Men at work," tags of distinctive appearance indicating that the equipment or lines so marked are being worked on.

Voltage or volts means the highest effective voltage between any two conductors of the circuit concerned, except that in grounded multiwire circuits, not exceeding 750 volts between outer conductors, it means the highest effective voltage between any wire of the circuit and the ground.

In ungrounded circuits not exceeding 750 volts, voltage to ground means the voltage of the circuit.

When one circuit is directly connected to another circuit of higher voltage (as in the case of an autotransformer), both are considered as of the higher voltage, unless the circuit of lower voltage is permanently grounded. Direct connection implies electrical connection as distinguished from connection merely through electromagnetic or electrostatic induction.

SEC. 40. SCOPE AND APPLICATION

400. SCOPE.

A. Sections 41 to 43.

The safety rules in sections 41, 42, and 43 do not apply to new construction not yet energized, but apply to the operation of, or to work on or about, the following:

1. Supply lines.
2. Communication lines used in connection with supply lines.
3. Electrical equipment of central stations, substations, and private plants.
4. Electrical tests.
5. Electrical work in tunnel, subway, or similar underground structures.

400—Continued.

B. Sections 44 and 45.

The safety rules in these sections apply to commercial telephone and telegraph, and other communication equipment and lines, with terminology adapted to the special needs of the employees concerned. Communication equipment and lines include fire and police alarm systems, district messenger systems, and other communication systems not operated in connection with supply lines.

401. APPLICATION.

While all the rules find application in the larger industrial or private plants and in moderate-sized utilities, some do not apply, or apply less fully, in the smaller ones. It has seemed unwise, however, to attempt to restrict the scope of these rules to rules which are applicable to all organizations or to all classes of electrical work.

402. EXPOSED COMMUNICATION LINES.

Communication equipment and lines are not considered alive, except where made alive by leakage from supply equipment or lines. They are, however, a source of danger when near live supply lines, due to their liability of being grounded.

SEC. 41. SUPPLY SYSTEMS—RULES FOR EMPLOYERS

410. GENERAL REQUIREMENTS.

A. Interpretation and Enforcement of Rules.

1. DISTRIBUTION.

The employer shall furnish to each regular employee operating or working on electrical supply equipment, supply or communication lines, or hazardous electrical tests a copy of these safety rules for operation (or such of these rules as ap-

410, A, 1—Continued.

ply to his work), either separately or incorporated in more comprehensive rule books, and shall take means to secure the employee's compliance with the same.

Note: Many companies number their books of rules and require a receipt from each employee for his copy.

2. INTERPRETATION.

If a difference of opinion arises with regard to the meaning or application of these rules or as to the means necessary to carry them out, the decision of the employer or his authorized agent shall be final, unless an appeal is taken to the regulative body having jurisdiction.

3. MODIFICATION.

Cases may arise where the strict enforcement of some particular rule will seriously impede the progress of the work in hand; in such cases the employee in charge of the work to be done may, with the consent of the chief operator concerned, make such temporary modification of the rule as will expedite the work without materially increasing the hazard.

B. Organization Diagram.

An organization diagram or written statement clearly showing the division of responsibility between officials and employees, down to and including the grade of foreman, should be supplied with the book of rules, or the rules should be posted conspicuously in offices and stations of the employer and in other places where the number of employees and the nature of the work warrants.

410—Continued.**C. First-Aid Rules and Physicians' Addresses.**

The rule book should contain or be accompanied by the following:

1. A list of names and addresses of those physicians and members of the organization who are to be called upon in emergencies.
2. A copy of rules for first aid, prone-pressure method of resuscitation and fire extinguishment. These should also be kept in conspicuous locations in every station and testing room, in line wagons, and in other places where the number of employees and the nature of the work warrants.

D. Instructing Employees.

Employees regularly working on or about equipment or lines shall be thoroughly instructed in methods of first aid, resuscitation by the prone-pressure method, and where advisable in fire extinguishment.

E. Qualifications of Employees.

The employer shall use every reasonable means and precaution to assure himself that each employee is mentally and physically qualified to perform his work in accordance with these rules.

F. Chief Operator.**1. AUTHORITY.**

A properly qualified chief operator, system operator, load dispatcher, general superintendent, or otherwise designated employee shall be in charge of the operation of electrical equipment and lines and directly responsible for their safe operation. His duties shall be those prescribed in rule 421, A.

410. F—Continued.

2. DEPUTY.

In large organizations the duties of the chief operator may be delegated for any particular section of the system to a deputy chief operator (or otherwise designated employee) who shall report as required to the chief.

3. LARGE ORGANIZATIONS OR EXTENDED SYSTEMS.

When it is impracticable to have the entire system placed in charge of one chief operator, the duties of the chief operator may be performed by a local superintendent, local manager, or other employee who may also perform other duties.

4. SMALL ORGANIZATIONS.

The duties of the chief operator in small organizations may be performed for a portion of the system by a local superintendent, electrician, engineer, or some other employee who may also perform other duties.

Note: In these rules the various employees listed by above titles, including the deputy chief operator, will be designated (for simplicity) by the title of chief operator, where referred to in this capacity.

G. Responsibility.

If more than one person is engaged in work on or about the same electrical equipment or lines at any one location, one of the persons shall be designated as the foreman locally in charge of the work; or, all of the workmen shall be instructed as to the work they are to perform, and the employee instructing the workmen shall be considered in charge of the work.

411. PROTECTIVE METHODS.

A. Attendance.

Unless a qualified employee is kept on duty where generators or rotary converters are operating, such equipment shall be made inaccessible to unauthorized persons.

B. Requirement for Two Workmen.

In wet weather or at night, at least two workmen should be assigned where the work is on or dangerously near live lines of more than 750 volts.

Exception: Trouble or emergency work is excepted.

C. Unqualified Workmen and Visitors.

Unqualified employees or visitors shall be prohibited from approaching any live parts, unless accompanied by a qualified employee.

D. Diagrams for Chief Operator.

Diagrams or equivalent devices, showing plainly the arrangement and location of the electrical equipment and lines, should be maintained on file or in sight of the chief operator.

Note: These diagrams may be of the entire system, or of each specific portion of the system, or they may show typical arrangements.

E. Instructions to Employees.

All employees shall be instructed as to the character of all equipment or lines on or dangerously near to which work must be done by them. Instructions shall describe the equipment and lines to be worked on, identifying them either by position, letter, color, number, or name.

411—Continued.

F. Protective Devices.

A supply of suitable protective, first-aid, and fire-extinguishing devices and equipment, sufficient to enable employees to meet the requirements of these rules, shall be provided in conspicuous and suitable places in electrical stations, testing departments, and line construction and repair wagons.

The following is a list of suitable devices and equipment, the kinds and numbers of which will depend on the requirements of each case:

1. First-aid outfits.
2. Insulating wearing apparel, such as insulating gloves, sleeves, and boots. Insulating shields, covers, mats, stools, and platforms. Insulating appliances, such as rods and tongs, for any necessary handling or testing of live equipment or lines.
3. Protective goggles of suitable materials and construction.
4. Tools of such special design and insulation as to eliminate so far as practicable the danger of forming short-circuits across conducting parts at different potentials or bringing the user into circuit with such parts.
5. "Men at work" tags, log books, operation diagrams, or equivalent devices, and portable danger signs.
6. Fire-extinguishing devices, either designed for safe use on live parts or plainly marked that they must not be so used.
7. Grounding devices for making protective grounds.

411—Continued.

G. Inspection of Protective Devices.

Such devices and equipment shall be inspected or tested to insure that they are kept in good order. Safety belts, whether furnished by employer or employee, should be inspected from time to time to assure that they are in safe working condition.

H. Warning Signs.

Permanent warning signs forbidding entrance to unauthorized persons shall be displayed in conspicuous places at all unattended and unlocked entrances to electrical supply stations, substations, and testing rooms containing exposed current-carrying parts or moving parts.

I. Danger Signs.

Suitable danger signs shall be placed in supply stations, substations, switching towers, and testing rooms about equipment having exposed current-carrying parts of more than 750 volts.

SEC. 42. SUPPLY SYSTEMS—GENERAL RULES FOR ALL EMPLOYEES

420. GENERAL PRECAUTIONS.

A. Rules and Emergency Methods.

The safety rules should be carefully read and studied. Employees may be called upon at any time to show their knowledge of the rules.

Employees should familiarize themselves with approved methods of first-aid, resuscitation, and fire extinguishment.

420—Continued.

B. Heeding Warnings, Warning Others.

Employees whose duties do not require them to approach or handle electrical equipment and lines should keep away from such equipment or lines.

They should cultivate the habit of being cautious, heeding warning signs and signals, and always warning others when seen in danger near live equipment or lines.

C. Inexperienced or Unfit Employees.

No employee shall do work for which he is not properly qualified on or about live equipment or lines.

Exception: Work done under the direct supervision of an experienced and properly qualified person is excepted.

D. Supervision of Workmen.

Workmen, whose employment incidentally brings them in the vicinity of electrical supply equipment or lines with the dangers of which they are not familiar, shall proceed with their work only when authorized. They shall then be accompanied by a properly qualified and authorized person, whose instructions shall be strictly obeyed.

E. Exercising Care.

Employees about live equipment and lines should consider the effect of each act and do nothing which may endanger themselves or others. Employees should be careful always to place themselves in a safe and secure position and to avoid slipping, stumbling, or moving backward against live parts. The care exercised by others should not be relied upon for protection.

420—Continued.

F. Live and Arcing Parts.

1. TREAT EVERYTHING AS ALIVE.

Electrical equipment and lines should always be considered as alive, unless they are positively known to be dead. Before starting to work, preliminary inspection or test should always be made to determine what conditions exist. (See rule 422, A, for general requirements and rule 424, C, for test of circuit.)

2. PROTECTION AGAINST ARCS.

The hands should be covered by protecting and insulating gloves and the eyes by suitable goggles or other means if exposed to injurious arcing. Either a thin rubber glove used with a protective outer glove or a heavier rubber glove used alone shall be considered as both protecting and insulating.

Employees should keep all parts of their bodies as far away as possible from brushes, commutators, switches, circuit-breakers, or other parts at which arcing is liable to occur during operation or handling.

G. Safety Appliances.

Employees at work on or near live parts should use the protective devices and the special tools provided. Before starting work these devices or tools should be examined to make sure that they are suitable and in good condition.

Note: Protective devices may get out of order or be unsuited to the work in hand.

420—Continued.

H. Suitable Clothing.

Employees should wear suitable clothing while working on or about live equipment and lines. In particular, they should keep sleeves down and avoid wearing unnecessary metal or inflammable articles, such as rings, watch or key chains, or metal cap visors, celluloid collars, or celluloid cap visors. Loose clothing and shoes that slip easily should not be worn near moving parts.

I. Safe Supports.

Employees should not support themselves on any portion of a tree, pole structure, scaffold, ladder, or other elevated structure without first making sure that the support is strong enough. Supports should be reinforced if necessary.

Conducting paint should not be used in painting portable ladders. Portable ladders should not be reinforced longitudinally with metal when used in electrical stations.

Portable ladders should be in a safe position before being climbed. The slipping of a ladder at either end should be carefully guarded against, especially where the supporting surfaces are smooth or vibrating.

J. Safety Belts.

Employees working in elevated positions should use a suitable safety belt or other adequate means to guard against falling. Before an employee trusts his weight to the belt, he should determine that the snaps or fastenings are properly engaged and that he is secure in his belt. Any employee who furnishes his own belt shall from time to time submit it to his employer for inspection.

420—Continued.

K. Fire Extinguishers.

Employees should avoid using fire-extinguishing liquids which are not insulating in fighting fires near exposed live parts. If necessary to use them, all neighboring equipment should first be killed.

L. Repeating Messages.

Each person receiving an unwritten message concerning the handling of lines and equipment shall immediately repeat it back to the sender and secure his full name and acknowledgment. Each person sending an unwritten message shall require it to be repeated back to him by the receiver and secure the latter's full name.

421. OPERATING ROUTINES.

A. Duties of Chief Operator.

The chief operator, described in rule 410, F, shall—

1. Keep informed of all conditions affecting the safe and reliable operation of the system.
2. Keep a suitable record or log book showing all changes in such conditions. He shall read and sign such record when assuming duty and sign again on being relieved.
3. Keep within sight operating diagrams or equivalent devices indicating whether electrical supply circuits are open or closed at stations under his immediate jurisdiction, and where work is being done under his special authorization.

Exception: These indicating devices shall not be required for any chief operators classed under paragraphs 3 and 4 of rule 410, F, if the record or log sheets show all conditions

421, A, 3, Exception—Continued.

affecting the safe and reliable operation of the system.

Note: In these rules the person performing these duties is designated as chief operator, regardless of his ordinary title.

B. Duties of Foreman.

Each foreman in charge of work shall adopt such precautions as are within his power to prevent accidents and to see that the safety rules are observed by the employees under his direction. He shall make all the necessary records, and shall report to his chief operator when required. He shall, as far as possible, prevent unauthorized persons from approaching places where work is being done. He shall also prohibit the use of any tools or devices unsuited to the work in hand or which are so defective or in such poor condition as to make them unsafe.

C. Qualified Guides.

The qualified persons accompanying uninstructed workmen or visitors near electrical equipment or lines shall take precautions to provide suitable safeguards and see that the safety rules are observed.

D. Special Authorization.**1. SPECIAL WORK.**

Special authorization from the chief operator shall be secured before work is begun on or about station equipment, transmission, or interconnected feeder lines or live lines of more than 7,500 volts, and in all cases where lines are to be killed by regular procedure at stations, and a report shall be made to him when such work ceases.

421, D, 1—Continued.

Exceptions: In emergency, to protect life or property, or when communication with the chief operator is difficult, due to storms or other causes, any qualified employee may make repairs on or about the equipment or lines covered by this rule without special authorization if the trouble is such as he can promptly clear with help available in compliance with the remaining rules. The chief operator shall thereafter be notified as soon as possible of the action taken. (See rule 421, H, 2, for crossed or fallen wires.)

2. OPERATIONS AT STATIONS.

In the absence of specific operating schedules for opening and closing supply circuits at stations, or starting and stopping equipment, employees shall secure special authorization from the chief operator before performing these operations. In all cases such special authorization shall be secured where circuit or equipment control devices are tagged at stations to protect workmen. (See rule 421, F, for tagging electrical circuits.)

Exceptions: In emergency, to protect life or property, any qualified employee may open circuits and stop moving equipment without special authorization if, in his judgment, his action will promote safety, but the chief operator shall be notified as soon as possible of such action, with reasons therefor. To maintain service, any qualified employee may also reclose circuits which have been opened by fuses or automatic circuit-

421, D, 2, *Exceptions*—Continued.

breakers except where this is prohibited by rule.

3. CUTTING OUT SECTIONS OF CIRCUITS.

Special authorization shall be secured from the chief operator before sections of overhead or underground circuits are cut off by employees at points other than at stations by means of sectionalizing switches.

Exception: Portions of distribution circuits of less than 7,500 volts may be cut off by authorized employees without special authorization from the chief operator, by means of sectionalizing switches, if the chief operator is thereafter notified as soon as possible of the action taken. This may also be done even for circuits of more than 7,500 volts when communication with the chief operator is difficult.

E. Restoring Service After Work.

No instructions for making alive equipment or lines which have been killed by permission of the chief operator to protect workmen shall be issued by him until all workmen concerned have been reported clear. When there is more than one workman at a location, a person authorized for the purpose shall report clear for such workmen, but only after all have reported clear to him. If there is more than one gang, each shall be so reported clear to the chief operator.

421—Continued.

F. Tagging Electrical Supply Circuits.

1. WHEN TAGS ARE PLACED AT DIRECTION OF CHIEF OPERATOR.

Before work is done at direction of chief operator on or about equipment or circuits, under any of the following conditions, the chief operator shall have "Men at work" tags attached at all points, where such equipment or circuits can be manually controlled by regular operators. The tags should be placed to plainly identify the equipment or circuits worked on.

- (a) Transmission or interconnected feeder circuits.
- (b) Circuits operating at more than 7,500 volts.
- (c) Circuits killed at stations and substations to protect workmen.

2. WHEN TAGS ARE PLACED AT DIRECTION OF AUTHORIZED EMPLOYEES.

Before work is done on or about any equipment or lines which are killed by authorized employees at points other than at stations, the employees shall have "Men at work" tags placed at all points where the circuit has been disconnected to identify the portion worked on.

G. Maintaining Service.

1. CLOSING TAGGED CIRCUITS WHICH HAVE OPENED AUTOMATICALLY.

When live circuits on which "Men at work" tags have been placed have opened automatically, they should be kept disconnected until the chief operator has given proper authorization for reconnection.

421, G—Continued.**2. CLOSING CIRCUITS OPERATED AUTOMATICALLY.**

When overhead circuits, other than trolley and third-rail circuits, open automatically, the employer's local operating rules shall determine in what manner and how many times they may be closed with safety for persons on or near those circuits. The chief operator shall be advised of the conditions.

3. GROUNDED CIRCUITS.

When circuits feeding supply lines become accidentally grounded, they shall be tested to determine where the ground exists. If the ground can not be definitely located and removed by the station operator, an immediate report of the finding shall be given to the chief operator, who shall order a patrol of the lines affected to definitely locate and remove the ground as soon as practicable.

Note: On circuits exceeding 7,500 volts, it will usually be found advisable to disconnect the circuit or effectively ground the accidentally grounded conductor until the lines have been cleared of the accidental ground.

H. Protecting Traffic.**1. ABRRIER GUARDS.**

Employees shall first erect suitable barrier guards before engaging in such work as may endanger traffic. They shall also display danger signs or red lamps placed so as to be visible to traffic approaching from any direction. A man shall be stationed to warn passers-by while work is going on where the nature of work and traffic requires it.

421, H—Continued.

2. CROSSED OR FALLEN WIRES.

An employee finding any crossed or fallen wires which may create a hazard shall remain on guard or adopt other adequate means to prevent accidents, and shall have the chief operator notified. If the employee can observe the rules for handling live parts by the use of insulating appliances, he may correct the condition at once; otherwise he shall first secure the authorization from the chief operator for so doing. (See rule 421, D, for special authorization.)

I. Protecting Workmen by Switches and Disconnectors.

When equipment or lines are to be disconnected from any source of electrical energy, for the protection of workmen, the operator shall first open the switches or circuit-breakers designed for operation under load, and then the air-break disconnectors, when provided.

422. HANDLING LIVE EQUIPMENT OR LINES.

A. General Requirements.

1. TOUCHING LIVE PARTS.

An employee should never touch with bare hands two parts at different potential at the same time. He should never touch with bare hands even a single exposed ungrounded live part at a dangerous potential to ground unless he is insulated from other conducting surfaces, including the ground itself, and stands on insulating surfaces.

2. WIRE INSULATION.

Employees should not place dependence for their safety on the insulating covering of wires.

422, A, 2—Continued.

All precautions in this section for handling live parts shall be observed in handling insulated wires.

Note: Insulation on a wire may look perfect, but it frequently will not prevent shock.

3. EXPOSURE TO HIGHER VOLTAGES.

Every employee working on or about equipment or lines exposed in overhead construction to voltages higher than those guarded against by the safety appliances provided should as far as practicable assure himself that the equipment or lines worked on are free from dangerous leakage or induction or have been effectively grounded

4. CUTTING INTO INSULATING COVERINGS OF LIVE CONDUCTORS.

When the insulating covering on live wires or cable must be cut into, the employee should use a suitable tool.

Recommendation: While doing such work, it is recommended that suitable goggles be worn to protect the eyes, and insulating gloves to protect the hands.

When metal sheathing must be removed from cables, it should be done with special tools which will not injure the insulation. The sheathing should be cut so as to leave enough exposed insulation after the conductor has been bared to avoid arcing over between the conductor and the sheath. If the cable consists of more than one conductor, similar exposed insulating surface should be left for each conductor, using insulating separators between conductors, if necessary.

422, A, 4—Continued.

Insulating devices, such as wood separators, etc., should be examined, and conducting dust or chips, sharp edges, or nails should be eliminated to avoid defeating the purpose for which the devices are intended.

5. METAL TAPES OR ROPES.

Metal measuring tapes, and tapes, ropes, or hand lines having metal threads woven into the fabric should not be used near exposed live parts.

6. METAL-REINFORCED LADDERS.

Ladders reinforced by metal in a longitudinal direction should not be used near exposed live parts.

B. Avoiding Shock—Voltages Between 750 and 7,500.

No employee should go, or take any conducting object without a suitable insulating handle, within 6 inches of any exposed live part whose voltage exceeds 750, where it is practicable to avoid this.

Where safe distance from live parts can not be secured by use of the special insulating tools and appliances furnished, properly tested insulating gloves and sleeves may serve as the sole portable insulating devices between the person and live parts.

Exception 1: In dry locations this distance may be less than 6 inches, if insulating devices, such as shields, covers, or gloves are placed between the person and the part or object.

Exception 2: In dry locations, the distance may also be reduced if insulating barriers (such as mats, stools, or platforms) are placed between the person and the ground, and suitable insulating

422, B, Exception 2—Continued.

shields between the person and all other conducting or grounded surfaces, which he could accidentally touch at the same time.

Exception 3: In all damp or dark locations, the distance may be less than 6 inches only if insulating devices are used between the person and the live parts and also between him and all other conducting surfaces with which he might otherwise come in contact at the same time.

Note: Care should be exercised in using insulating gloves to avoid puncturing them on sharp edges, especially in making wire splices. It is sometimes advisable to wear protecting gloves over insulating gloves.

C. Avoiding Shock—Voltages Exceeding 7,500.**1. CLEARANCES FROM LIVE PARTS.**

No employee should go, or take any conducting object, within the distances named below from any exposed live part at or above the voltage specified.

Clearance from Live Parts

Operating voltage:	Distance in feet
7,500.....	1
15,000.....	2
50,000.....	3
70,000.....	5

Distances for intermediate voltages to be determined by interpolation.

Exception: In dry locations these distances may be reduced if suitable insulating guards or barriers are placed between the person and such part or object.

422, C—Continued.

2. GUARDS.

If the part is being directly worked on, the tools or other mechanical appliances used shall have insulating handles of sufficient length to permit the operator to maintain the distance specified in rule 422, C, 1, preceding.

Exception: This does not apply if protective guards are also used between the person and the live part.

Note: These protective guards may be permanent insulating covers or shields, or may be disks of insulating material, suitable for the voltages to be handled and for the attendant conditions, attached to the handles of rods or tools.

D. Requirement for Two Workmen.

In wet weather or at night no employee shall work alone on or dangerously near live lines of more than 750 volts.

Exception: Trouble and emergency work is excepted.

E. When to Kill Parts.

An employee shall not approach, or willingly permit others to approach, any exposed ungrounded part normally alive closer than permitted by rule 422, A, B, or C, unless the supply equipment or lines are killed.

Note: This is to ensure the employee of his own safety and the safety of those working under his direction.

F. Opening and Closing Switches.

Manual switches and disconnectors should always be closed by a single unhesitating motion, and, if possible, with one hand. Care should be exercised in opening switches to avoid causing serious arcing.

422—Continued.

G. Work from Below.

Employees should avoid working on equipment or lines from any position by reason of which a shock or slip will tend to bring the body toward exposed live parts. Work should, therefore, generally be done from below, rather than from above.

H. Attaching Connecting Wires and Grounds.**1. HANDLING CONNECTING LINES.**

In connecting dead equipment or lines to a live circuit by means of a connecting wire or device, employees should first attach the wire to the dead part before attaching it to the circuit. When disconnecting, the live end should be removed first. Loose conductors shall be kept away from exposed live parts.

2. APPLYING GROUNDS.

In applying a grounding device to normally live parts, the device shall be grounded before being brought near the parts and shall be removed from the live parts before being removed from the ground connection.

I. Handling Series Circuits.

Secondaries of current transformers to meters or other devices should not be opened when alive until a jumper has been connected across the point of opening or the circuit has been short-circuited elsewhere.

Before working on arc lights connected to series circuits, they shall be short-circuited or (when necessary to avoid hazard) disconnected entirely from such circuits by absolute cutouts.

422—Continued.

J. Stringing Wires.

In stringing wires near live conductors, they should be treated as alive unless they are effectively grounded.

423. KILLING EQUIPMENT OR LINES.

A. Application of Rule.

Where workmen must depend on others for operating switches to kill circuits on which they are to work, or must secure special authorization from the chief operator before themselves operating such switches, the following precautionary measures shall be taken in the order given, before work is begun on or about the equipment or lines concerned, as a means for preventing misunderstanding and accident.

In small organizations the chief operator may himself operate the switches and disconnectors instead of instructing others to do so, thus much simplifying and abbreviating the procedure. In certain cases the chief operator may direct the workman who wishes the section killed for his own protection to operate some or all switches necessary himself, thus also abbreviating the procedure.

In cases where there is no station with regular attendants at either end of a section of line to be killed for the protection of workers, the rules below need not apply for disconnection of that end of the section concerned, provided that the employee under whose direction that end of the section is disconnected is in sole charge of the section and of the means of disconnection employed or that the point of disconnection at that end of the section is suitably tagged before work proceeds.

423—Continued.

B. Workman's Request.

The workman in charge of the work shall apply to the chief operator to have the particular section of equipment or lines killed, identifying it by position, letter, color, number, or other means.

C. Opening Disconnectors and Tagging.

The chief operator at his discretion shall direct the proper persons to open all switches and air-break disconnectors through which electrical energy may be supplied to the particular section of equipment and lines to be killed, and shall direct that such switches and disconnectors be tagged with a tag of a distinctive character indicating that men are at work. All oil switches and remotely controlled switches should also be blocked where necessary for avoiding mistakes.

A record shall be made when placing the tag giving the time of disconnection, the name of the man making the disconnection and the name of the workman who requested the disconnection, and the name of the chief operator.

Where the section of equipment or lines can be made alive from two or more sources, all such sources shall be disconnected.

Note: This will apply to work on lines with more than one station, also sometimes to work on transformers in banks, rotary converters, motor generators, switches, and on other similar equipment.

D. Station Protective Grounds.

When all the switches and disconnectors designated have been opened, blocked, and tagged in accordance with rule 423, C, the chief operator shall require that protective grounds be made upon the

423, D—Continued.

lines which have been killed and that they are reported to him when placed.

Exception: This requirement does not apply under conditions where the making of such grounds will itself be more hazardous than working on lines without grounding.

E. Permission to Work.

Upon receipt of information from all persons operating switches and disconnectors that protective grounds are in place, the chief operator shall advise the workman who requested the killing of the section that the specified section of equipment or line has been killed and that he may proceed to work.

F. Workmen's Protective Grounds for Overhead Lines.

The workman in charge should immediately proceed to make his own protective grounds on the disconnected lines, except under conditions where the making of such grounds will itself be more hazardous than working on the lines without grounding. Such grounds shall be made between the particular point at which work is to be done and every source of energy.

G. Proceeding with Work.

After the equipment or lines have been killed (and grounded, if required by F above), the workman in charge and those under his direction may proceed with work on the grounded or killed parts. Care, however, shall be taken to guard against adjacent live lines or parts.

H. Procedure for Other Gangs.

Each additional workman in charge desiring the same equipment or lines to be killed for the protec-

423, H—Continued.

tion of himself or the men under his direction shall follow the same procedure as the first workman and secure similar protection.

I. Reporting Clear—Transferring Responsibility.

The workman in charge, upon completion of his work, and after assuring himself that all men under his direction are in safe positions, shall remove his protective grounds and shall report to the chief operator that all tags protecting him may be removed, and shall give his location and report as follows: "Mr. ——— and men clear and all grounds removed."

The workman in charge who received the permission to work may transfer this permission and the responsibility for men under him, as follows:

He shall personally inform the chief operator of the proposed transfer, and if this is permitted, the name of the successor shall be entered at that time on the tags concerned or in the records of the persons placing the tags and of the chief operator. Thereafter the successor shall report clear and shall be responsible for the safety of the original workmen, so far as this is affected by the removal of tags.

J. Removal of Tags.

The chief operator shall then direct the removal of tags for that workman and the removal shall be reported back to him immediately by the persons removing them. Upon the removal of any tag, there shall be added to the record the name of the chief operator and workman who requested the tag, the time of removal, and the signature of the person removing the tag.

423—Continued.**K. Restoring Service.**

Only after all protecting tags have been removed by the above procedure from all points of disconnection shall the chief operator, at his discretion, direct the removal of protective grounds and blocks and the closing of any or all disconnectors and switches.

424. MAKING PROTECTIVE GROUNDS.**A. Application of Rule.**

When making temporary protective grounds on a normally live circuit, the following precautionary measures shall be observed in the order given, and the ground shall be made to all wires of the circuit which are to be considered as grounded.

B. Ground Connections.

The employee making a protective ground on equipment or lines shall first connect one end of grounding device to an effective ground connection supplied for the purpose.

C. Test of Circuit.

The normally live parts which are to be grounded should next be tested for any indication of voltage, the employee carefully keeping all portions of his body at the distance required from such parts when alive by the use of suitable insulating rods or handles of proper length, or other suitable devices.

D. Completing Grounds.

If the test shows no voltage, or the local operating rules so direct, the free end of the grounding device shall next be brought into contact with the normally live part and securely clamped or otherwise secured thereto before the employee comes within the distances from the normally live parts specified in rule

424, D—Continued.

422, B and C, or proceeds to work upon the parts as upon a grounded part.

In stations, remote-control switches can sometimes be employed to connect the equipment or lines being grounded to the actual ground connection. On lines it is generally necessary to resort to portable grounding devices or chains handled directly by means of insulating handles, rods, or ropes.

E. Removing Grounds.

In removing a protective ground the employee shall not remove the grounding device from the ground connection until the device has been disconnected from all normally live current-carrying parts.

SEC. 43. SUPPLY SYSTEMS—RULES FOR EMPLOYEES DOING SPECIALIZED WORK**430. SUPPLY STATIONS AND SWITCHBOARDS.****A. Application of Rule.**

Engineers, machine attendants, switchboard operators, and helpers shall study and strictly observe the following, in addition to all the general rules 420 to 424 which apply to their work.

B. Care About Machines.

Do not allow oil cans, tools, dusters, or wiping cloths to catch in moving parts of machinery. In passing any switchboard or machine in operation, do not touch it unnecessarily nor allow metal tools or other metal objects to touch the apparatus or connections. Do not use iron or tin oil cans near field magnets, and use only dusters and wipers with insulating handles on or about exposed live parts. Employees about to work on normally moving parts of remotely controlled equipment during

430, B—Continued.

periods of rest, shall be protected against their accidental starting by "Men at work" signs first being placed on the starting devices, and by locking or blocking these where practicable. All employees shall, before starting any work, satisfy themselves that all these protective devices have first been installed. (See rule 423.)

C. Care About Live or Moving Parts.

Do not work on or near exposed live or moving parts unless authorized to do such work, and then strictly observe the rules applying.

When working near fuses and circuit-breakers or other apparatus which may arc suddenly, be careful to avoid injury from their operation.

When working on one section of a switchboard or in one compartment, mark it conspicuously and place barriers to prevent your accidental contact with live parts in that section or adjacent sections.

When working on or about live parts and standing on insulated stools or ladders, or when otherwise insulated from the ground, avoid handing metal tools or other objects to other persons who are not insulated.

D. Handling Fuses or Brushes.

In handling fuses of more than 750 volts, use the special rods or tongs and stand on insulating platforms or mats, where provided. Keep the body as distant and as far below as possible.

Replace or remove link fuses from live terminals and handle brushes on live equipment only when absolutely necessary, and then with due precautions.

430—Continued.

E. Battery Rooms.

Do not smoke or cause arcing in storage-battery rooms. The use of open flames should be avoided, especially while the cells are gassing and should be permitted only in special cases under the direct supervision of an experienced person and after the room has been thoroughly ventilated.

Do not handle live parts of batteries or their connections unless standing on insulating platforms or wearing suitable insulating boots.

F. Working in Elevated Positions.

When working in an elevated position, especially above live or moving parts, assure yourself of the security of your position and support, and take precautions to avoid dropping tools or materials.

G. Handling Switchboard Equipment.

All ungrounded metal parts of devices on switchboards shall be handled as if operating at the highest voltage to which any portion of the equipment on the same switchboard panel is subject, unless the parts are known, by test or otherwise, to be free from such voltage.

When cable plug connectors are used, do not allow one end to remain hanging loose while the other end is connected to a live terminal.

In handling instrument circuits, the secondary of a current transformer should never be opened when it is alive.

H. Reporting Circuit Trouble to Chief Operator.

Report to your immediate superior or to the chief operator any unusual conditions of load and the indication of any accidental ground on an outgoing circuit.

430—Continued.**I. Reporting Defects.**

Promptly report to your superior any dangerous conditions of equipment or surroundings, including defective tools, switches, or protective devices, or live cases or frames of apparatus or instruments.

431. METERS.**A. Application of Rule.**

All meter setters and testers shall study and strictly observe the following in addition to all the general rules in 420 to 424 which apply to their work.

B. Taped Joints.

Never leave joints or loose ends of wires untaped unless otherwise protected.

C. Care About Live Parts.

Do not use bare fingers or hands to determine whether a circuit is alive. Never remove or replace fuses in live circuits of more than 750 volts except by means of the suitable appliances provided.

D. Opening Circuits at Switches.

Special care should be exercised in opening circuits at meter connections unless the circuits have been first properly opened at switches.

E. Current-Transformer Secondaries.

Before working on an instrument or other device in a current-transformer secondary circuit, always bridge the device with jumpers, so that the circuit can not be opened at the device. Never open such a circuit at meter connections until it has been elsewhere bridged.

F. Special Tools.

Use only hand tools suited to the work in hand and so reduce the danger of short-circuits.

431—Continued.**G. Reporting Defects.**

Promptly report to your immediate superior any live meter case or any condition of a meter or its connections, of the interior wiring or of overhead lines, of your own or other utilities, which might endanger life and property.

432. TESTING.**A. Application of Rule.**

All electrical testers, helpers, and others working about electrical tests shall study and strictly observe the following, in addition to all the general rules in 420 to 424. Owing to the diversified character of testing work, this study should usually extend also to the special rules in 433 to 435.

B. Authorization for Work.

Do not work on or about equipment or lines without first receiving authorization from the person in charge.

Note: If such equipment or lines are under control of a chief operator, this authorization must come from him. This will include the attaching of tags at the proper points and the observation of all rules for general operation in 421.

C. Checking of Conditions.

Thoroughly familiarize yourself with all conditions surrounding equipment or lines to be tested before making any change in these conditions.

Do not make any change in equipment or lines unless you fully understand the effect of the change.

D. Foreman.

One properly qualified person shall be in immediate charge of all testing work, or all of the workmen shall be instructed as to the work they are to per-

432, D—Continued.

form and the employee instructing them shall be considered in charge of the work.

E. Warnings and Barriers.

Display danger signs and erect suitable guards about all equipment or lines under test when in places where traffic is frequent, if live or moving parts would otherwise be exposed.

When temporary wiring, belts, pulleys, or other temporary live or moving parts must be guarded, suitable portable or temporary guards and warning signs shall be used.

F. Requirement for Two Workmen.

No person should work alone in testing or experimental work on or about parts on which the voltage can exceed 750 volts, except in routine testing where the live parts are properly guarded.

G. Reporting Defects.

Promptly report to your immediate superior any conditions of equipment or lines under test which may endanger life or property.

433. OVERHEAD LINES.

A. Application of Rule.

Linemen and assistants and groundmen, in construction, extension, removal, or repair work, shall study and strictly observe the following, as well as all the general rules in 420 to 424 which apply to their work.

B. Testing Structures Before Climbing.

Before climbing poles, ladders, scaffolds, or other elevated structures, first assure yourself that the pole, ladder, scaffold, tree, cross arm, messenger wire, cable car, or boatswain's chair, or other elevated support, is strong enough to safely sustain your weight.

433, B—Continued.

Note: Poles may be tested for decay near the ground line with a bar, screw driver, or other tool, and sounded for decay at the center by rapping with a heavy tool or block of wood.

When poles or cross arms are apparently unsafe because of decay or unbalanced tensions of wires on them, they should be properly braced or guyed before they are climbed.

C. Use of Pole Steps.

When poles are stepped, make use of such steps in climbing.

D. Unsafe Supports.

Do not support yourself by pins, brackets, or conductors.

E. Spurs.

Spurs with gaffs worn short shall not be used. The gaffs on spurs shall be kept sharp, and spurs shall fit properly. Spurs shall not be worn on work for which they are not required, nor while men are traveling to or from work.

F. Care About Live Parts.

1. Do not go among any wires until you know their voltage.
2. Leaning over and crowding through unprotected wires should be avoided wherever possible.
3. Place yourself so that you will not be liable to fall on wires should an accident occur.
4. Do not depend on the insulating covering of wires, and treat all lines as alive unless they have been properly killed (except communication lines known to be clear).

433, F—Continued.

5. Avoid use of hand lines or measuring tapes containing metal strands.
6. In handling dangerous switches or fuses, do so only by means of suitable insulating handles, rods, or tongs.

G. When Touching Live Parts.

When working on live equipment or wires never allow any portion of the body to come in contact with any live or grounded part other than that worked on.

While touching supply wires or equipment, avoid as far as possible touching ground wires, guy wires, span wires, metal pipes, metal poles, metal sheaths, communication wires or equipment, transformer cases, hangers, and other metal fixtures.

Note: Communication wires are included principally because of their liability of being grounded. The other equipment and wires listed may become either alive or grounded.

While touching communication wires or equipment, metal sheaths, metal pipes, ground wires, or metal fixtures on poles, avoid as far as possible touching supply wires or equipment, guy or span wires.

H. Protecting Traffic.

When working overhead, keep tools and materials not in use in proper receptacles; tools or materials should not be thrown to or from the man on the pole, but should be raised or lowered by means of a hand line, using proper receptacles where practicable.

Pole holes and obstructions along public highways and other frequented places shall be protected by watchmen or by suitable guards or danger signals so located as to be conspicuous to traffic.

433, H—Continued.

When working overhead, or hoisting or lowering materials above places where frequent traffic occurs, a man should be stationed to warn passers-by.

Note: Where traffic is light, warning signs or barriers may be used in lieu of watchmen. Where traffic is congested, it may be necessary to rope off the space.

I. Avoid Falling Objects.

Do not unnecessarily stand where you can be struck by materials dropped by men working overhead.

J. Stringing Lines.

Never string wire near live lines except by means of suitable insulating hand lines or other appliances. Avoid bringing them in contact with the live lines. Regard them as live wires of the same voltage because of their liability to come in contact with the live lines.

Never change the strains on a pole by adding or removing wires until assured that the pole will stand the altered strains.

In stringing wires do not allow them to sag so as to endanger vehicles or pedestrians below, unless traffic is intercepted by watchmen or otherwise.

K. Reporting Defects.

Report promptly to your immediate superior any dangerous conditions of your own or other utilities observed arising from defective insulators, pins, cross arms, abnormally sagging wires, etc.

434. SERIES STREET LAMPS.**A. Application of Rule.**

All series-lamp trimmers, hangers, and inspectors shall study and strictly observe the following, in

434, A—Continued.

addition to the general rules in 420 to 424 and the special rules under the sections for overhead and underground operation, respectively, in 433 and 436 which apply to their work.

B. Precautions on Series Circuits.

Series lamps and devices in series circuits should always be treated as alive unless disconnected by absolute cut-outs or protected by the grounding of the circuit.

C. Handling Series Lamps.

Trimmers, inspectors, or patrolmen shall wear suitable insulating gloves and stand on insulating stools, platforms, or tower wagons, or on dry, well seasoned wood poles while touching series lamps or their cut-outs, when these are alive.

Where insulating stools, platforms or tower wagons are used which provide sufficient insulation from ground for the voltages to be handled, the insulating gloves may be dispensed with.

D. Bridging Series Lamps.

Before working on lamps or other devices in live series circuits always bridge the device with jumpers such as series lamp cut-outs usually provide.

Note: This will insure that the circuit will not be opened at the device, and possibly be completed through your body or will not arc at the point of opening and burn you.

E. Testing Series Lamp Circuits.

Series lamp circuits should not be tested at their full operating voltage unless it is impracticable to test otherwise. Tests should be made only in accordance with a time schedule, concerning which all persons whose safety may be affected are informed.

434—Continued.

F. Periodically Disconnected Circuits.

If circuits, such as series lamp circuits, are not effectively grounded during the idle period, all rules for handling live parts shall be strictly observed.

G. Reporting Defects.

Report promptly to your immediate superior any abnormally sagging wires, broken insulators, leaning poles, defective pole steps, broken globes or lamp supports, and other defects giving rise to a dangerous condition of your own or other utilities, or any indication of voltage on lines supposed to be dead.

435. COMMUNICATION CIRCUITS USED IN CONNECTION WITH SUPPLY LINES.**A. Application of Rule.**

All men working on or near telephone and telegraph lines operated in connection with supply lines shall study and strictly observe the following in addition to all the general rules in section 42 and the special rules 433 and 436 which apply to their work. For rules governing the operation of commercial communication lines see sections 44 and 45.

B. Title of Official in Charge.

In those rules where the words "chief operator" are used the official in charge of safeguarding operation is to be understood.

C. Precautions Before Climbing Poles.

Make a careful inspection to ascertain if possible whether there are any crosses with supply circuits before climbing poles or other structures to work on or about communication wires, especially where such poles or structures are occupied in common with, or located near power circuits.

435, C—Continued.

Apply mechanical tests as far as practicable to messenger wires before trusting the wires to carry your weight.

D. Approaching Supply Wires.

Avoid contact with all wires other than those you know to be communication wires, assuming such other wires always to be alive.

Do not approach any supply wire or supply equipment within the distances given in rule 422, B and C, unless you can comply with all the rules under that section, as far as they apply.

Note: Communication wires in trouble may be in contact with supply wires at some distant point, and should be treated with proper care.

E. Touching Equipment.

While handling communication wires, metal sheaths, or communication equipment avoid touching guy or span wires and supply wires or equipment. Especially avoid standing on or touching transformer cases, hangers, or connections.

While touching open communication wires avoid contact also with grounded parts, such as sheaths and ground wires.

F. Stringing Wires.

When stringing wires or cables over or under supply lines avoid any possibility of their coming in contact. Do not string them above live supply lines where it is practicable to avoid it.

Where liability of contact can not be entirely avoided, the lines being handled shall be treated as alive (unless they are effectively grounded), and the rules of 422, so far as they are applicable, shall be carefully observed.

435—Continued.

G. Reporting Dangerous Conditions.

Promptly report to the proper official abnormally sagging wires, broken or defective insulators, pins, cross arms, defective poles, or any other dangerous conditions of your own or other utilities.

436. UNDERGROUND LINES.

A. Application of Rule.

All cable splicers and other workmen in underground construction or operation shall study and strictly observe the following, in addition to the general rules in 420 to 424, which apply to their work.

B. Guarding Manholes, Handholes, and Street Openings.

When removing manhole or handhole covers or making excavations, promptly protect the opening with a barrier, temporary cover, or other suitable guard, and see that danger signals or red lights are displayed in a location conspicuous to the traffic until permanent covers are in place or the excavations are filled.

C. Testing for Gas.

Do not enter manholes until you have assured yourself that the manholes are free from dangerous gases, by testing with approved safety lamps, by ventilation, or by other adequate methods. (See rule 452, B, for testing for gas.)

D. Watchman on Surface at Manholes.

Do not enter a manhole unless a temporary cover is placed over the opening or a watchman is stationed at the surface. Where any gas is liable to be present always see that the watchman is stationed at the surface. Where any hazard is involved do not leave a manhole unwatched until all workmen are out.

436—Continued.**E. Avoiding Flames.**

Do not smoke in manholes and avoid as far as practicable open flames or torches in or near manholes. Avoid sparks in handling live parts or cable sheaths, and avoid igniting the flux in soldering and wiping joints. In using hot paraffin see that it does not reach a temperature at which it will ignite. (See rule 452, D, for avoiding flames.)

F. Pulling Cables.

When pulling in cables make sure that the gear can not slip so as to injure workmen. Avoid the danger of having the hands drawn into the tackle by the pulling line.

G. Unidentified Cables.

If lines and cables are not properly identified by markings or positions, do not work upon them.

H. Testing and Splicing Live Cables.

Always ascertain, if practicable, whether cables are alive, by testing with the test devices provided, before cutting into the cable sheaths. Live cable should be spliced only by men experienced in the work, and they should use extreme caution and suitable devices in so doing.

I. Reporting Defects.

Promptly report to your immediate superior any dangerous condition of your own or other utilities, whether observed in underground or overhead construction. Particularly report insanitary conditions, gas, or missing cable tags in manholes, and abnormally sagging wires or broken supports in overhead construction.

437. TUNNEL AND SUBWAY.**A. Application of Rule.**

Tunnel and subway electricians, operators, and others working on or about underground electrical equipment (not in stations, substations, or in underground conduit systems) shall study and strictly observe the following, in addition to the rules in 420, 421, 422, 430, and 436, so far as they apply to their work.

B. Dangerous Locations.

The value of insulation (insulating covering) as protection from shock is reduced by the dampness usually present in these and similar locations. The restricted spaces often bring the worker closer to equipment and wires than in other kinds of electrical work, and the imperfect illumination also makes special care necessary to avoid contacts. The human body and all surrounding surfaces become more conducting where dampness exists, and electrical shocks are, therefore, more severe.

C. Live Electrical Parts.

Before handling any electrical equipment or wires make sure whether they are alive or dead.

Note: It is not advisable to work on live equipment or wires when the current can be shut off without interrupting necessary operations.

D. Unauthorized Work.

Never touch or disturb any electrical equipment or wires without being authorized.

437—Continued.

E. Standing on Ground.

1. Do not touch any electric wire, cable, or third rail, no matter how well it is insulated, while you are standing on the ground or on a grounded conducting surface, such as a pipe, track, or rail.
2. Do not touch the metal frame or case of a motor if it is ungrounded, and you are in contact with ground or a grounded object.

Note: Remember that the surfaces of damp ground and water are conducting. Insulation on a wire may look perfect, but it frequently will not prevent shock.

F. Carrying Tools.

In carrying tools or metal implements in passageways containing electric wires, especially near exposed wires, never permit the tools or implements to touch them.

In particular, do not carry such objects on the shoulder when there are conductors overhead. Do not travel on that side of passageways where third rails or side trolley wires are exposed.

G. Handling and Repairing Live Parts.

1. When necessary to handle or repair live trolley wires, third rails, cables, motors, or other electrical equipment, wear suitable insulating gloves or stand on the waterproof insulating mats or platforms provided, or obtain dry wood free from metal.

Do not rely entirely on gloves for protection. The gloves may have been punctured since they were previously tested.

437, G—Continued.

2. Before handling or making use of any electrical cable, carefully examine it to make sure that its insulation is not injured.

H. Inspection of Portable Cables.

Portable cables should be inspected at least once daily during the period of their use.

I. Handling Portable Devices.

In handling portable motors or lamps, first make sure that the external metal frame is not alive by contact with or leakage from live parts within.

Have such portable devices inspected at least once daily during the period of their use.

J. Fuses and Switches.

Never handle fuses nor close switches or circuit-breakers unless you are authorized to perform that special duty, and then use the insulating handles or rods provided.

Before closing switches first make sure that you are not endangering other persons.

K. Injuring Cables and Wires.

Do not fire shots (blasting), handle tools, or perform other work in such a manner as to injure cables or wires in the vicinity. If in doubt, consult your superior.

L. Temporary Wiring.

Never arrange the wiring of any temporary circuit for earth return, nor use bare conductors.

Note: This particularly applies to the temporary portions of shot-firing circuits and to the leads of portable motors and lamps.

Never employ temporary circuits without seeing that there are installed at the junction with the permanent

437, L—Continued.

wiring, suitable disconnecting switches or plug connectors, arranged to disconnect all conductors of the temporary circuit by a single operation.

For shot-firing circuits, their disconnectors should be left open until the shot is to be fired, and should preferably be arranged for locking in the open position.

M. General Precautions.

Never get on or off locomotives or cars on the side where the trolley wire or third rail is located.

Do not place combustible or explosive materials near electric wires, trolley tracks, third rails, or motors.

Do nothing that will cause sparking, or expose parts that may arc or spark during operation, if any explosive gases are present.

N. Reporting Dangerous Conditions.

Promptly report to your superior any dangerous or unusual conditions observed. In particular, report the presence of gas, broken insulators, bad insulation on wires, defective third-rail construction, live frames of motors, broken ground wires on motor frames, and sparking, arcing, or shocks noticed at any point. Report also any fallen, crossed, or abnormally sagging wires, whether electric wires or not. This includes trolley wires at switches and crossings and wires injured through falling roofs.

SEC. 44. COMMUNICATION SYSTEMS—RULES FOR EMPLOYERS**440. DISTRIBUTION AND ENFORCEMENT OF RULES.****A. Distribution.**

The employer shall furnish to each regular employee working on or about commercial telephone or tele-

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graph equipment or lines, safety rules governing his conduct while so engaged, and shall take suitable means to secure the employee's compliance with the same.

B. Form.

The safety rules furnished to any employee may be in such form as the employer may determine is best suited to the needs of individual employees. They shall, however, include the principles set forth in the following rules, or at least such part thereof as is applicable to the work in which the employee is engaged, and shall not conflict with these rules.

C. Interpretation.

If a difference of opinion arises with regard to the meaning or application of these rules, or as to the means necessary to carry them out, the decision of the employer or his authorized agent shall be final, subject to an appeal (if taken) to the regulative body having jurisdiction.

441. ADDRESS LIST AND EMERGENCY RULES.

The rule books should contain or be accompanied by the following:

- A. A list of names and addresses of those physicians and members of the organization who are to be called upon in emergencies.
- B. A copy of rules for first aid, prone-pressure method of resuscitation, and fire extinguishment.

These should also be kept in conspicuous locations in central offices, on line wagons, and in other locations where the number of employees and nature of the work warrants.

442. INSTRUCTING EMPLOYEES.

Employees regularly working on or about communication equipment or lines, if their duties render such training necessary, shall be thoroughly instructed in approved methods of first aid, the prone-pressure method of resuscitation, and fire extinguishment, and if advisable, regularly drilled.

Groups of employees, such as commercial telephone operators, shall be thoroughly drilled to make prompt and orderly exit from buildings in case of fire.

443. QUALIFICATION OF EMPLOYEES.

The employer shall use every reasonable means and precaution to assure himself that each employee is mentally and physically qualified to perform his work in accordance with these rules, and that he is not addicted to the use of intoxicants and habit-forming drugs.

444. PROTECTIVE DEVICES.

There shall be provided in conspicuous and suitable places in stations and on line wagons a sufficient supply of suitable protective, first-aid, and fire-extinguishing equipment to enable employees to meet the requirements of these rules. Such devices and equipment shall be inspected or tested to insure that they are kept in good order. The following is a list of suitable devices and equipment, the kinds and numbers of which will depend on the requirements of each case:

- A. First-aid outfits.
- B. Insulating wearing apparel, such as insulating gloves, boots, and shields.
- C. Safety belts.
- D. Fire-extinguishing apparatus.

**SEC. 45 COMMUNICATION SYSTEMS—RULES FOR
EMPLOYEES****450. GENERAL PRECAUTIONS.****A. Heeding Warnings, Warning Others.**

Employees should cultivate the habit of being cautious, heed warning signs and signals, and always warn others when seen in danger near equipment and lines.

B. Inexperienced Employees.

No employee shall do work for which he is not properly qualified on or about equipment or lines, except under the direct supervision of an experienced and properly qualified person.

C. Electrical Supply Equipment or Wires.

Workmen whose duties do not require them to approach or handle electrical supply equipment and wires should keep away from such equipment or wires.

Electrical supply equipment and wires should always be considered as alive unless positively known to be dead.

D. Safe Supports and Safety Belts.**1. SAFE SUPPORTS.**

Employees should not support themselves on any portion of a tree, pole structure, lamp bracket, or similar fixtures on poles, scaffold, ladder, roof, skylight, or other elevated structure without first making sure that the supports are strong enough, reinforcing them if necessary. Portable ladders should be in a safe position before being climbed. The slipping of a ladder at either end should be carefully guarded against,

450, D, 1—Continued.

especially where the supporting surfaces are smooth or vibrating.

Insecure makeshift substitutes for ladders should not be used. An employee should never trust his weight on thin wooden boxes, sinks, wash-bowls, window shelves, or chair backs.

A ladder should not be placed upon a box, barrel, or other movable or insecure object.

Care should be taken to see that chairs, rolling ladders, and similar equipment are in first-class condition before being used.

2. SAFETY BELTS.

Employees should not work in elevated positions unless secured from falling by a suitable safety belt or other adequate means (sometimes including suitably located pole steps). Before an employee trusts his weight to the belt, he should determine that the snaps or fastenings are properly engaged and that he is secured in his belt.

3. SAFETY ROPES.

Ropes used for supporting boatswains' chairs, platforms, or for other purposes on which the security of the employee depends shall be frequently inspected to assure that they are maintained in good condition.

E. Duties of Forman.

1. DUTIES.

Each foreman in charge of work shall see that the safety rules are observed by the employees under his direction. He shall make all necessary records; reporting to his superior when

450, E, 1—Continued.

required. He shall permit only authorized persons to approach places where work is being done. He shall adopt such precautions as are within his power to prevent accidents, and prohibit the use of tools or devices which are defective, or not suited to the work in hand.

2. QUALIFIED GUIDES.

The qualified person accompanying uninstructed workmen or visitors near electrical equipment or lines shall take precautions to provide suitable safeguards and see that the safety rules are observed.

F. Handling Live Parts.

No employee should touch, with bare hands, any exposed ungrounded live part or more than 150 volts to ground, unless he is insulated from other conducting surfaces, including the ground itself. When employees must touch, at the same time, two parts between which a considerable potential exists, insulating gloves or other protection shall be used.

G. Power Circuits in Central Offices.

When making repairs on electric light or power circuits, the circuits shall, whenever possible, be made dead.

Where practicable, moving apparatus, as, for example, a fan, shall be stopped before working upon it. None other than duly authorized persons shall be admitted to central-office transformer vaults or battery rooms.

Care shall be used while working on or near circuits of more than 150 volts to ground, particularly in alternating-current districts.

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H. Handling Fuses or Brushes.

When working on the brushes of a machine in operation, employees shall use care not to break a circuit, the flashing of which may injure the eyes or burn the hands. If it is necessary to remove a brush from the holder, the machine shall be shut down.

When inspecting or changing fuses, care should be taken to prevent injury to the eyes. If it is necessary to handle the fuses, the circuit should be cut off, if possible.

I. Battery Rooms.

Do not smoke or cause arcing in storage-battery rooms. The use of open flames should be avoided, especially while the cells are gassing, and should be permitted only in special cases under the direct supervision of an experienced person and after the room has been thoroughly ventilated.

451. OVERHEAD LINES.

A. Precautions to be Observed Before Climbing Structures.

Before climbing poles, ladders, scaffolds, or other elevated structures first assure yourself that the pole, ladder, scaffold, tree, cross arm, messenger wire, cable car, or boatswain's chair, or other elevated support is strong enough to safely sustain your weight.

On pole-replacement work no pole shall be climbed for the purpose of clearing it of all wires and cables without first guying or bracing the pole securely.

Where poles or cross arms are apparently unsafe because of decay, or unequal strains of wire on them,

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they should be properly braced or guyed, if necessary, before they are climbed.

An uncoiled hand line, rope, or wire of any sort should not be fastened to the employee while climbing a pole, but where this must be done the employee should exercise due care to prevent the line from catching on obstructions.

In climbing poles careful watch should be kept for nails or other foreign attachments which might catch in the clothing and cause a fall.

B. Use of Pole Steps.

When poles are stepped make use of such steps in climbing, first making sure that the steps are firmly set in solid material before trusting your weight upon them. Pay particular attention, on icy poles, to each step.

Do not support yourself by pins, brackets, or conductors.

C. Spurs.

Spurs with gaffs worn short shall not be used. The gaffs on spurs shall be kept sharp and spurs shall fit properly. Spurs shall not be worn on work for which they are not required, nor while men are traveling to or from work.

D. Approaching Supply Lines.

Avoid contact with all wires other than those you know to be communication wires, assuming such other wires always to be alive. Communication wires in trouble may be in contact with supply lines at some distant point, and should be treated as live supply lines unless known to be free from any dangerous voltage.

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Do not approach any supply line or supply equipment within the distances given in rule 422 under section 42, unless you comply with all the rules under that section.

E. Touching Equipment.

While handling communication wires, metal sheaths, or communication equipment avoid touching trolley or arc-lamp span wires and supply lines or equipment. Especially avoid standing on or touching transformer cases, hangers, or connections.

F. Care About Electrical Supply Lines.

Do not go among any wires until you know their voltage.

Leaning over and crowding through unprotected supply wires should be avoided wherever possible.

Place yourself so that you will not be liable to fall on supply wires should an accident occur.

Do not depend on the insulating covering of wires, and treat all wires as alive unless they have been killed properly (except communication wires known to be clear).

Treat also as alive all wires (unless thoroughly grounded) which are being strung near supply wires; regard them as being of the same voltage as the supply wires.

Avoid use of hand lines or measuring tapes containing metal strands.

When necessary to work in the vicinity of supply wires, transformers, and similar equipment assure yourself before starting work that the position of the body is such that should you momentarily forget yourself or fall, no portion of the body will come in contact with the foreign wires or equipment. Have

451, F—Continued.

the supply circuits killed where possible before approaching them.

Railway span wires, pull-offs, and trolley brackets shall be treated as if alive, even though equipped with strain or other insulators.

G. Stringing Wires.

Never string wires near live circuits except by means of suitable insulating hand lines or other appliances.

Avoid the use of single or paired wires as a substitute for a hand line.

Wires should not be strung above live circuits operating at more than 750 volts, unless the wires being strung are effectively grounded or otherwise suitably protected, or in handling them all the precautions are observed as provided in rule 422, for work on parts at the voltage of the circuits concerned, and the spacings maintained.

Never change the strains on a pole by adding or removing wires until assured that the pole will stand the altered strains.

When wires are being pulled up on corner poles employees should stand in such a position that they can not be struck by the wire in case it slips.

Where it is necessary to remove communication wires below which are supply wires, power should be shut off of the supply wires where possible, and, if this is not practicable, rope cradles and suitable guards should be erected. Extraordinary care should be exercised to prevent the communication wires from sagging into the supply wires.

In stringing wires, cables, messengers, span wires, or guys do not allow them to sag so as to endanger

451, G—Continued.

vehicles or pedestrians below, unless traffic is intercepted by watchmen or otherwise. This may necessitate keeping a watchman at the coil or reel.

When stringing wires for long distances, precautions shall be taken to prevent the possibility of vehicles or pedestrians coming into contact with the wires at the intersecting streets or highway crossings.

H. Protecting Traffic.

When working overhead, keep tools and materials not in use in proper receptacles; tools or materials should not be thrown to or from the man on the pole, but should be raised or lowered by means of a hand-line, using a proper receptacle, if practicable. Also tools and loose materials should not be left at the top of poles, ladders, or other elevated structures.

Workmen shall not stand where they are liable to be struck by materials dropped by men working overhead.

Pole holes, open manholes, excavations, and obstructions along the public highway and other frequented places shall be protected by watchmen, barriers or suitable guards, warning signs, or danger signals so located as to be conspicuous to traffic.

When working overhead or hoisting or lowering materials above places where traffic occurs, a man should be stationed to warn passers-by.

Where traffic is light, warning signs may be used in lieu of watchmen. Where traffic is congested, it may be necessary to rope off the space.

I. Reporting Dangerous Conditions.

Report promptly to your immediate superior any observed dangerous conditions of your own or other

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utilities arising from defective insulators, pins, cross arms, abnormally sagging wires, etc.

Any imminently dangerous conditions shall be guarded until they can be made safe.

452. UNDERGROUND LINES.**A. Guarding Manholes, Handholes, and Street Openings.**

When removing manhole or handhole covers or making excavations, promptly protect the opening with a barrier, temporary cover, or other suitable guard, and see that danger signals or red lights are displayed in a location conspicuous to the traffic until permanent covers are in place or the excavations are filled.

B. Testing for Gas.

Do not enter manholes until you have assured yourself that the manholes are free from dangerous gases, as indicated by approved safety lamps, by ventilation, or by other adequate methods.

When work is being carried on in manholes for any length of time where gas collects, suitable ventilation shall be provided, or tests with the safety device should be repeated at regular intervals to make certain that gas is not accumulating in the manhole in dangerous quantities.

C. Watchman on Surface at Manhole.

Where any hazard to the workmen is involved observe the following:

1. Do not enter a manhole unless a man is stationed at the surface.
2. Do not leave a manhole unwatched until all workmen are out.

452—Continued.**D. Avoiding Flames.**

Do not smoke in manholes, and avoid as far as practicable open flames or torches in or near manholes.

If it is necessary to illuminate a manhole, electric lights only should be used. When doing this, it should be known that the leads, sockets, and connections are well insulated and in good condition in order to avoid the possibility of a spark. Special attention should be paid to the sparking of any motors used for ventilating purposes.

Avoid sparks in handling live parts or cable sheaths, and avoid igniting the flux in soldering and wiping joints. In using hot paraffin see that it does not reach a temperature at which it will ignite.

In central-office cable vaults, tests shall be made for the presence of gas before using exposed flames, and such flames shall not be used in vaults where gas collects.

E. Pulling Cables.

When pulling cables, make sure that the gear can not slip so as to injure workmen. Avoid the danger of having the hands drawn into the tackle by the pulling line.

F. Reporting Dangerous Conditions.

Promptly report to your immediate superior any dangerous condition of your own or other utilities, whether observed in underground or overhead construction. Particularly report unsanitary conditions, gas, or missing cable tags in manholes and abnormally sagging wires or broken supports in overhead construction.





