DEPARTMENT OF COMMERCE

CIRCULAR

OF THE

BUREAU OF STANDARDS

S. W. STRATTON, DIRECTOR

No. 49

SAFETY RULES

TO BE OBSERVED IN THE OPERATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT AND LINES

[1st Edition]
Issued August 1, 1914

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CONTENTS

52909°—14——2

SAFETY RULES TO BE OBSERVED IN THE OPERATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT AND LINES

INTRODUCTION

The study of life and property hazards incident to the generation, distribution, and use of electrical energy includes the consideration of construction methods on the one hand and of operating methods on the other. Improvements in construction and isolation of dangerous parts must be largely depended upon for the protection of the uninstructed public, while the safeguarding of operation and maintenance must remain the principal factor in the safety of electrical workmen for whom isolation is necessarily less complete. To a lesser extent the security of the public also must depend on the protective operating methods employed and on the care of the electrical workers.

Analysis of the available electrical accident data shows a large proportion of accidents to be preventable by the observance of definite operating precautions. A considerable number of electrical utilities and some manufacturing companies have published sets of such operating rules as were suggested by their own experience or derived from the experience of other companies. Recently the value of such rules in promoting the safety of public and employees has been given more widespread attention, and some study of the subject has been made independently by several State commissions.

For about a year the Bureau of Standards has been engaged in a study of safety rules to govern the operating practice of employers and employees on electrical work. Both practice and results are found to vary widely in different localities, and hence local opinion and custom are not a sufficient guide for commissions and companies desiring to secure adequate protection of this character. Where rules have their source entirely in local experience or in casual exchange of experiences they may be open to the objection that precautions are prescribed to prevent a particular class of accident only after

such an accident has occurred locally. They may thus permit the occurrence of accidents which might be avoided by the observance of rules proceeding from a broader study and experience. Thousands of the smaller companies, in the absence of sufficient data and experience to prepare rules, have no printed rules in effect. The growth of compensation laws has emphasized the urgent necessity for State commissions to adopt safety rules for the electrical industry as well as for other industries, and the demand for an adequate standard set of such rules has now become general.

After extended comparisons and analyses of existing sets of rules and aided by the suggestions of commissions, company officials, and workmen, a code of safety rules has been drawn up and is now offered for criticism, discussion, and in so far as may be found possible, for general adoption.

Each rule has been subjected to the careful scrutiny of our own investigators and others, to determine the necessity for such a requirement and its general applicability under the varying conditions of operation. The needs of the class of workers to which any rule is addressed have been kept constantly in mind, and the workers of this class freely consulted. Concreteness has been especially sought, as well as clearness and conciseness.

Having carefully weighed the individual rules to retain only those essential to properly safeguarding operation, it has seemed most desirable to separate the rules into groups under different headings in order to facilitate reference and to procure a more logical arrangement.

Division has been made into (1) requirements resting upon the employer, (2) those applying generally to all electrical employees, and (3) those applicable to special classes of electrical work.

The rules for the employer are subdivided for convenience into two groups. The first covers matters relating to the organization, the issuance of rules, diagrams and emergency instructions to employees, the determination of the qualifications of employees by suitable examinations, and the division of responsibility among employees. The second treats of the portable safeguards which the employer should provide, the operating precautions which he should enforce, and the uniform reporting of accidents on which the ultimate analysis and elimination of electrical accident causes must depend, which latter is so inadequately handled by most States and companies to-day. The employer is required to enforce the observance of the safety rules issued to the employees.

The general rules for the employees are subdivided into six groups. The first enumerates those general precautions the necessity for which seems

obvious but the noncompliance with which is nevertheless responsible for many injuries. The second presents general operating rules, defining the duties and relations of those employees who direct others and the operating methods by which safety is secured. The third group prescribes the precautions for handling live parts under varying conditions of voltage and location. The fourth and fifth deal with the procedures for assuring the continued safety of work about normally live or moving parts, respectively, by avoiding all possible sources of misunderstanding in killing parts. The sixth group covers in some detail the procedure for making protective grounds and short circuits.

Special rules for employees are grouped into separate headings, each covering those peculiar to some special class of electrical work. Each class of worker is directed to familiarize himself also with the general rules which apply to all classes of electrical employment. By this arrangement a more adequate treatment has been realized without unnecessary repetition.

The comment of those commissions, companies, and workmen whose study of the subject has been most extended has been distinctly favorable to the arrangement and substance of the rules given in this edition. Many commissions and companies, after some study of the problem, are preparing similar codes. The requirements of such codes should undoubtedly be closely harmonized to secure the best results in reducing as much as possible the accident toll of our indispensable electrical service. The results of the study of the Bureau of Standards should be advantageous in securing uniformity of requirements.

In presenting this first edition of a code of rules we offer our appreciative acknowledgment of the hearty cooperation received from national organizations, State commissions, company officials, and individuals. We particularly request additional constructive criticism, suggestions, and data for use in preparing a second edition of the rules.

To the other recognized natural advantages of electrical distribution, that of a low degree of hazard to workmen and the public may be added by a careful attention to those precautions proven in practice to result generally in a reduced number of accidents.

The limited experience of a single workman, or even of a single company, may lead to incomplete and erroneous conclusions and correspondingly few and inadequate rules, but combined experience and coordinated study can not but result in generally correct conclusions and rules really adequate for their purpose.

Great advantage will result to companies and workmen alike by the general adoption by the several States of a single standard set of safety rules, which can be revised from time to time in accordance with the progress of the art and the combined experience of all the companies and commissions of the country. Thus will every State and every company secure the advantage of the experience of all.

Where particular rules do not apply, their omission will of course cause no conflict in practice. If it is necessary for any State commission to adopt additional rules, that could be done at any time by special orders. This would be easier and less confusing than to have a different set of rules for each separate State.

The present urgent demand for a standard set of safety rules is due to a very general recognition of the need of such rules. The following rules are offered with the hope that they will prove to be a valuable contribution toward meeting this public need, and with the belief that the general adoption and use of these rules will result in a material reduction in the present life hazards to electrical workers, and the economic waste to the electrical industries which these entail.

S. W. Stratton,
Director.

Approved:
E. F. Sweet, *Acting Secretary.*

SCOPE OF THE RULES.

The following safety rules apply to the operation of, and work on or about power and signal lines, the electrical equipment of central stations, substations, private plants, electrical tests, and tunnel, subway, or similar underground work.

General rules are addressed to the employer and to the employees followed by those rules under separate headings which refer to special classes of employees.

It is intended that employees should thoroughly familiarize themselves with all the general rules as well as those which relate to their particular work.

While all the rules find application in the larger industrial or private plants or moderate-sized utilities, some do not apply (or apply less fully) to the smaller organizations. It has seemed unwise, however, to attempt to restrict the scope of the rules to those which are applicable to the smallest organizations or to the simplest classes of electrical work, since the number of workers so employed is small, compared with the total number to whose work uniform rules should apply.

These rules do not cover requirements for the construction, installation, and maintenance in safe condition of electrical lines and equipment. Such rules, which are also necessary for the safety of employees and the public, will be included in a separate set.

Part I.—RULES FOR THE EMPLOYER

A. ORGANIZATION

1. Copy of Rules

Each employee operating or working on or about electrical supply equipment, power or signal lines, or electrical tests shall be furnished with a complete copy of these safety rules.

2. Organization Diagram

To assure the safe and accurate performance of work and to avoid delays in emergencies, an organization diagram or plan clearly showing the division of responsibility between members of his part of the organization, shall be supplied to each employee operating or working on or about equipment or lines.

3. Address List and Emergency Rules

Each employee shall be provided with 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, resuscitation, and fire extinguishment.

4. Drilling Employees

Employees working on or about equipment or lines shall be thoroughly and regularly drilled in approved methods of first aid, resuscitation, and fire extinguishment.

5. Posting Rules and Diagrams Permanently

Copies of the organization diagram, address list, and emergency rules shall be permanently posted in a conspicuous location in every station, testing room, and in every line wagon.

6. Qualification of Employees

Each employee must be qualified for the work he has to perform. He shall be given his authorization for any work only after he has demonstrated his fitness for that kind of work by examination. No employee shall be permitted to work unless he be in a competent mental and physical condition and uses neither intoxicants nor drugs.

The employee shall be instructed in the application of these rules to his work, and periodical examination shall be given to determine the employee's continued fitness for work and his knowledge of the safety rules.

52909°—14——3

7. Chief Operator

A properly qualified chief operator, wire chief or other official, shall be placed in full charge of all operating electrical equipment and lines, and he shall be directly responsible to the management for the safe conduct of all operation and, except with signal equipment, of construction also.

8. Local Foreman

A properly qualified foreman shall be placed locally in charge of all work on or about electrical equipment or lines, at the point where such work is being done, if two or more men are engaged in such work.

9. Reinspection

Inspection shall be regularly made to insure that the employees retain their copies of rules, diagrams, and instructions, and that posted instructions and diagrams are maintained in good order.

B. PROTECTIVE METHODS AND DEVICES

1. Attendance

A qualified employee shall be kept on duty where generators or rotary converters are operating, excepting small, low voltage generators for telephone and similar work.

2. Two Workmen

There shall be provided at least two employees on any work near exposed live parts of equipment and lines above 750 volts in stations, in testing rooms, or on overhead lines, or above 150 volts from earth in underground construction, where it is necessary to approach such parts within the distances specified in Part II, section E, rules 2 and 3.

3. Visitors and Uninstructed Workmen.

No employee shall be allowed to work alone about any live parts unless he has demonstrated his fitness to do so.

No visitor or unqualified employee shall be allowed to approach any live parts, unless accompanied and warned by a qualified employee.

4. Diagrams for Chief Operator

Diagrams showing plainly the arrangement and location of all parts of the electrical equipment and lines must be maintained on file with the chief operator.

The line diagrams must show for each pole or other support on or near which power lines are carried the relative position, voltage, and use of all

power and signal lines carried on or near that supporting structure, and for each crossing with any other lines whatsoever, must show the relative position, voltage, and use of all lines.

5. Diagrams for Foreman

Diagrams or other suitable means for identifying all power equipment or lines near which work must be done shall be supplied to the foreman locally in charge of such work.

6. Identification

All equipment and lines shall be placed in definite positions or be marked by letter or number, so that they can readily be identified. Each diagram of equipment or lines shall be marked correspondingly.

All instructions to employees shall describe the equipment and lines and also identify them by position, letter, or number.

7. Protective Devices

There shall be provided in conspicuous and suitable places in electrical stations a sufficient supply of the following protective, first-aid, and fire-extinguishing devices, all of approved kinds and quality:

(NOTE.—The kinds and numbers of such devices will depend on the requirements of each case.)

(*a*) First-aid outfits.

(*b*) Insulating wearing apparel (such as insulating gloves, sleeves, boots, etc.) and insulating shields, covers, mats, and platforms, which shall be tested within 30 days and after any week's use of such devices, each marked with the highest voltage against which it may be used as protection.

(*c*) Protective goggles with suitable glasses and insulating frames.

(*d*) Insulating appliances, such as rods, tongs, electroscopes, etc., for any necessary handling or testing of live equipment or lines, each marked with the highest voltage against which it may be used as protection.

(*e*) 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.

(*f*) "Men at work" tags, foreman's record cards, log books, operating diagrams or equivalent devices, and portable danger signs.

(*g*) Fire-extinguishing covers and appliances, either designed for safe use on live parts or plainly marked that they must not be so used.

(*h*) Heavy blankets, waterproof coats, hats, and boots.

(*i*) Grounding devices for making protective grounds.

The above devices shall be kept, when not in use, in their regular location and in good working order.

Safety belts, whether furnished by employer or employee, should be tested periodically to assure their safety.

8. Line Wagon and Testing Room Protective Devices

There shall be provided in every line wagon and testing department a sufficient supply of the devices noted under items *a*, *b*, *c*, *d*, *e*, *f*, and *i*, of rule 7. These shall be kept, when not in use, in their regular location and in good working order.

9. Warning and Danger Signs

There shall be displayed in conspicuous places outside all entrances to electrical supply stations and testing rooms approved permanent warning signs forbidding entrance to unauthorized persons.

Danger signs shall be placed in power stations and testing rooms about equipment having exposed current-carrying parts above 750 volts, stating the operating voltage.

10. Accident Reports

Report blanks shall be issued to each employee and their use required for reporting to the employer each personal injury on or about equipment and lines. These shall contain at least the following information and shall be required to be filled out at the time of the accident:

(*a*) Date, time, and locality.

(*b*) Age and nationality, and does person speak English?

(*c*) Regular occupation, occupation at time of accident, and years of such occupation.

(*d*) Extent of injury.

(*e*) How did accident occur?

(*f*) Was original cause of injury electrical or otherwise?

(*g*) What defects of construction, protection, illumination, or carelessness were concerned in the accident?

(*h*) Were other employees present?

(*i*) What first aid was given, how soon after the injury, and how long continued?

(*j*) Suggested improvements for preventing similar accidents.

(*k*) Voltage.

11. Enforcement of Rules

The employer shall require employees to comply with the safety rules.

Part II.—GENERAL RULES FOR THE EMPLOYEE

C. GENERAL PRECAUTIONS

1. Study the Rules

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

2. Be Cautious

To reduce the hazard of handling equipment and lines, employees should cultivate the habit of being cautious and always heed warning signs and signals.

3. Warn Others

Employees should always warn others when they are seen in danger near live lines or equipment.

4. Keep Away from Danger

Employees whose duty does not require them to approach or handle electrical equipment and lines, must not come near such equipment or lines.

5. Inexperienced Employee

No employee shall work on or about live lines or equipment except under the direct supervision of an experienced and properly qualified person, unless he himself is properly qualified.

Employees should not do any work which they believe themselves unable to safely perform.

6. Treat Everything as Alive

Electrical lines and equpiment should always be considered as alive unless they are positively known to be dead. Accidental contacts with live parts should be carefully avoided.

7. Exercise Care

Employees about live equipment and lines must consider the effect of each act, and do nothing which may endanger themselves or others. Slipping and stumbling or moving backward should be carefully avoided. The care exercised by others must not be entirely relied on for protection.

8. Safety Appliances

Employees at work on or near live parts should use the safety devices and special tools provided, first making sure that these devices and tools are suitable and in good condition. Safety devices may get out of order or be unsuited to the work in hand.

Where the eyes may be endangered by arcing, goggles should be worn.

9. 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 supports are strong enough, reinforcing them if necessary. Portable ladders should be secured in position before being climbed. The slipping of a ladder at either end must be carefully guarded against, especially where the surfaces are smooth or vibrating.

10. Safety Belts

Employees shall not work in elevated positions unless secured in position by approved safety belts or by other adequate means.

11. Suitable Clothing

Employees shall wear suitable clothing while working on or about live equipment and lines. In particular, they should keep sleeves down and avoid wearing unnecessary metal articles. Near moving parts loose clothing must be avoided.

12. Emergency Methods

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

13. Report Defects

Employees shall promptly report any condition of lines or equipment which can endanger life or property.

14. Supervision of Uninstructed Employees and Other Workmen

All workmen whose employment incidentally brings them in the neighborhood of electrical supply lines or equipment shall proceed with their work only when authorized, and accompanied by a properly qualified person authorized by the chief operator, and then shall strictly obey his instructions.

15. Duties of Supervisor of Uninstructed Employees

The person accompanying workmen near electrical equipment or lines for the protection of such workmen, must first have such equipment or lines

properly protected by insulating barriers if the safety of the workmen demands such precautions.

He must prevent unsafe approach of any workman to live equipment or lines.

He must see that the general rules which apply to work about equipment or lines are observed, in all respects, by the workmen.

16. Repeat Messages

To avoid misunderstandings, each person receiving an unwritten message shall immediately repeat it back to the sender, and secure his acknowledgment. Each person sending an unwritten message shall require it to be repeated back to him by the receiver.

D. GENERAL OPERATION

1. Duties of Foremen

Each foreman in charge of work shall see that the safety rules are observed by the employees under his direction. He shall make all the records required, reporting to the chief operator. He shall permit only authorized persons to approach the point where work is being done.

2. Duties of Chief Operator

The chief operator shall keep a log book showing all changes in the conditions of operation, including the starting and stopping of electrical supply equipment, the location and nature of work started or completed on equipment or lines, the name of each foreman locally in charge of work, and all unusual occurrences or accidents.

He shall sign the log book when assuming duty and before being relieved.

He shall keep within sight an operating diagram or equivalent device indicating whether electrical supply circuits are open or closed, and where work is being done.

It shall be his further duty to enforce the safety rules and to permit only authorized persons to approach equipment or lines.

3. Control of Electrical Supply Circuits

Employees shall secure special authorization from the chief operator before closing circuits or starting equipment, and before opening circuits or stopping equipment.

Exceptions.—In emergencies, to protect life and property, any employee may open circuits and stop moving equipment without special authorization,

if he is sure that his action will promote safety, but the chief operator must be notified immediately of his action with the reasons therefor. To maintain service, any employee may also reclose circuits opened by automatic cut-outs, subject to the provisions of Rule 6.

4. Authorization for Work

Special authorization from the chief operator shall be secured before work is begun on or about equipment or lines and a report shall be made to him when such work ceases. When there is more than one workman at any location, the foreman locally in charge shall secure the authorization.

Exception.—In emergencies, to protect life or property, or when communication with the chief operator is impossible, due to storms or other causes, any employee may make repairs on or about equipment or lines without special authorization if he is sure that his action will promote safety, and that the trouble is such as he can promptly clear with the help available, in compliance with these rules. The chief operator must thereafter be notified as soon as possible of the action taken.

5. Reporting Clear

No instructions for making alive equipment or lines which have been killed to protect workmen shall be issued by the chief operator until all workmen have reported clear. When there is more than one workman at a location, the foreman locally in charge of such dead equipment or lines shall report clear for all his workmen, only after all have reported clear to him. If there is more than one gang, each foreman shall separately report clear to the chief operator.

6. Maintaining Service

When circuits above 750 volts automatically open immediately after each of three consecutive closings, they shall be disconnected until they have been found clear by proper test.

When circuits at which men are known to be at work are opened automatically, they shall be disconnected until the chief operator has ascertained that the workmen are safe and he has given proper authorization.

When circuits feeding supply lines become accidentally grounded, by indication of ground detectors at stations, they shall be opened, and if upon trial closing the ground still exists the lines shall be disconnected until they have been found clear by proper tests.

7. Tagging Electrical Supply Circuits

Before work is done on or about any equipment or lines, either dead or alive, the chief operator shall have "Men at work" tags attached at all points where such equipment or lines can be manually controlled, to plainly identify them.

8. Protecting Traffic

Before engaging in such work as may endanger traffic, employees shall first erect suitable barrier guards, and display danger signs or red lamps from two sides of the barrier at right angles to the direction of the traffic. While work is going on a man shall be stationed to warn passers-by.

9. Protecting Workmen

When lines or equipment are to be disconnected from any source of electrical energy, for the protection of workmen, the operator must first open the manual cut-outs designed for operation under load, and then the air-break disconnectors.

E. HANDLING LIVE EQUIPMENT AND LINES

(NOTE.—Signal equipment and lines are excluded except where made live by leakage from power equipment or lines.)

1. Touching Live Parts

No employee shall touch two parts of different potentials at the same time.

Employees shall not touch any exposed ungrounded live parts at any voltage unless insulated from floors and other conducting surfaces by approved insulating covers, mats, or platforms. If permanent devices are not provided, portable ones shall be used.

Concrete, masonry, earth, and the wet surfaces of wood poles, platforms, and other structures are conducting surfaces.

2. Extra High Potentials

No employee shall come or bring any conducting object within the distances named below, from any exposed ungrounded live part at or above the voltage specified:

Operating voltage	Distance (feet)
7 500	2
27 000	3
47 000	4
70 000	6

52909°—14——4

In dry locations these distances may be reduced, if approved insulating or grounded metal barrier devices are placed between the person and such part or object.

If the part is being directly worked on, the tools or other mechanical appliances used must provide the full distance of insulating material unless protective barriers are also used between the person and the live part.

3. High Potentials

No employee shall come or bring any conducting object within 1 foot of any exposed ungrounded live part whose potential exceeds 150 volts in underground construction, or 750 volts in stations, testing rooms, or overhead construction.

In dry locations this distance may be reduced, if approved insulating or grounded metal devices are placed between the person and the part or object. This distance may also be reduced if approved insulating barriers are placed between the person and ground, as well as between the person and all other conducting surfaces which he could accidentally touch at the same time.

In all damp or dark locations or where grounded surfaces are exposed, unless grounded metal barrier devices are employed, insulating devices must be used both between the person and the live parts and between him and all other conducting surfaces.

Where greater space can not be secured by use of the special insulating tools and appliances furnished, or as an additional safeguard, properly tested insulating gloves and sleeves may serve as portable insulating devices between the person and live parts below 7500 volts.

Insulating gloves shall never be used to handle sharp edges, especially in making wire splices.

4. Exposure to Higher Voltages

Each employee working on or about equipment or lines exposed in overhead construction to higher voltages shall treat such lines as of the higher voltage, unless they are positively known to be free from leakage or the parts worked on or about are effectively grounded.

5. Two Workmen

No employee shall work within the distances specified in rules 2 and 3 of this section from any exposed live lines or apparatus above 150 volts in underground construction or 750 volts in stations, test rooms, or overhead construction, unless another person is present.

6. Wire Insulation

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

An insulated wire should never be touched without observing all the precautions for handling live equipment or lines.

7. Work from Below

Employees must not work from above on exposed live parts of equipment or lines when work can be done 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.

8. Opening and Closing Switches

No employee shall open a cutout not designed for interrupting a loaded circuit unless the circuit has first been interrupted at a proper cut-out.

Manual cutouts shall always be opened or closed by a single unhesitating motion and, if possible, with one hand.

All cutouts shall be handled only by means of the insulating handles provided.

9. Loose Wires

Loose conductors should never be brought near exposed live parts except those to which they are to be immediately connected.

10. Handling Connecting Wires

In connecting dead equipment or lines to a live circuit by means of a connecting wire or device, employees shall first apply the wire to the dead part before attaching it to the circuit. When disconnecting, the live end shall be removed first.

11. Never Open Series Circuits

Series circuits, or secondaries of current transformers, shall never be opened.

A jumper must always be connected across any device inserted in such a circuit before working on the device.

12. Applying Grounds

In applying a grounding device to normally live parts the device must be grounded before bringing it near the parts and must be removed from the live parts before removing it from the ground connection.

13. Stringing Lines

In stringing wires near live lines the wires being handled should be treated as alive unless they are effectively grounded by approved devices.

14. Fire Extinguishers

Fire-extinguishing liquids or covers which are not insulating should never be employed in fighting fires near exposed live parts. If necessary to use them, always have all neighboring equipment killed.

15. Protection Against Arcs

Employees must keep all parts of their bodies as distant as possible from brushes, commutators, switches, circuit breakers, or other parts at which arcing can occur during operation or handling.

If the hands must be used near such parts, they must be protected by insulating gloves.

If the eyes are not otherwise shielded from possible arcing, they must be protected by insulating goggles with suitable lenses.

F. KILLING SUPPLY EQUIPMENT AND LINES

1. Ascertain if Parts are Dead

No employee shall approach any exposed ungrounded part, normally alive, within the distances specified in paragraphs 2 and 3 of section E, except as allowed in those rules, unless he has first assured himself of his own safety, and that of those working under his direction, by taking the following precautionary measures in the order given:

2. Foreman's Request

The foreman locally in charge of the work shall request from the chief operator permission to have the particular section killed.

3. Chief Operator's Acknowledgment

The chief operator shall, at his discretion, advise the foreman that the particular section will be killed and that instructions will be given the foreman when he can safely proceed.

4. Opening Disconnectors and Tagging

The chief operator shall direct the proper persons to open all disconnectors, including suitable air-break cutouts, through which electrical energy may be supplied to the particular section to be killed and shall require each person to lock each disconnector open, and to tag the same, and each tag shall state in large letters "Men at work."

The person shall, when placing the tag, record thereon the time of disconnection, his own name, who requested the disconnection, and the name of the chief operator.

Where equipment or lines can be made alive from two or more sources, all such sources must be disconnected. This will apply to work on lines with more than one station; also to transformers in banks, rotary converters, motor generators, switches, and much other equipment.

5. Protective Grounds

When all disconnectors designated have been opened, locked, and tagged, the chief operator shall require each person operating them to make protective grounds upon the section which is to be killed and to report when such grounds are in place.

6. Permission to Work

Upon receipt of information from all persons operating disconnectors that protective grounds are in place, the chief operator may advise the foreman that he may proceed to work, considering the specified lines or equipment dead.

7. Foreman's Record and Grounds

The foreman shall record on a card for the purpose the time lines or equipment are reported dead, the particular lines or equipment specified, the name of the chief operator, and sign his own name. He shall then immediately proceed (except in underground systems) to make his own protective ground on the disconnected section of the equipment or lines in the manner specified under section H.

Grounds shall be made on the dead equipment or lines between the particular point at which work is to be done and each disconnector which has been opened by the above procedure for his protection.

8. Proceed with Work

After the section has been killed the foreman and those under his direction may proceed with work on or about the dead section without necessarily complying with the rules under section E.

9. Other Gangs

Each additional foreman desiring the same section of equipment or lines killed for the protection of himself or the men under his direction shall follow the same procedure as the first foreman and secure similar protection

10. Reporting Clear

Each foreman 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 report himself (Mr. ———) "In the clear" to the chief operator and record the time of such report on his record card.

11. Reporting Removal of Tags

The removal of any tag from any disconnector shall be reported immediately to the chief operator by the person removing it.

Upon the removal of any tag there shall be added to its record the name of the chief operator, the time of removal, who requested removal, and the signature of the person removing the tag. The tag shall then be filed with the chief operator.

12. Restoring Service

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

The chief operator shall permanently file all tags and all record cards of the foremen.

G. KILLING MOVING PARTS

1. Ascertain if Parts are Dead

No employee shall work on or about any part of equipment which is at rest, but which normally moves, unless he has first assured himself that no movement endangering him or others working with him can occur, by taking the following precautionary measures in the order given.

2. Foreman's Request

The foreman shall request from the chief operator permission to have the particular moving parts killed.

3. Chief Operator's Acknowledgment

The chief operator shall, at his discretion, advise the foreman that the particular parts will be killed and that instructions will be given the foreman when he can safely proceed.

4. Locking and Tagging

The chief operator shall direct the proper persons to so adjust all cutouts, valves, or other devices by which motion can be imparted to such

parts, that such motion will be prevented, and to lock the devices in a safe position.

A person so directed shall place at each device a "Men at work" tag, recording on each tag the time of adjustment, who requested the adjustment, the name of chief operator, and his own name.

5. Permission to Work

Upon receipt of information from all persons operating cutouts, valves, or other devices, the chief operator may advise the foreman that he may proceed to work, considering the specified moving parts dead.

6. Foreman's Record

The foreman shall record on a card for the purpose the time he is authorized to proceed with work, the particular part specified, the name of chief operator, and his own signature. He may then proceed to work.

7. Other Gangs

Each additional foreman desiring the same moving parts killed shall secure authorization in the same manner from the chief operator.

8. Reporting Clear

Each foreman upon completion of his work and after assuring himself that all men under his direction are in safe positions shall report to the chief operator that his tag may be removed from each starting device at which placed and shall report himself (Mr. ———) "In the clear," to the chief operator and record the time of such report on his record card.

9. Reporting Removal of Tags

The removal of any tag from any starting device shall be immediately reported to the chief operator by the person removing it, who shall record on the tag time of removal, who requested the tag, name of chief operator, and his own signature. The tag shall then be filed with the chief operator.

10. Restoring Service

Only after all protecting tags are properly removed from all starting devices may the chief operator direct the removal of locks and the operation of any starting device.

The chief operator shall permanently file all tags and record cards.

H. MAKING PROTECTIVE GROUNDS

1. Procedure

When making protective grounds on a circuit the following precautionary measures must be observed in the order given, and the ground must

be made to each wire of the circuit separately, unless after the first is grounded the others are successively short circuited with it.

2. Ground Connection

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

3. Test of Station and Test Room Ground Connection

To assure the continuity of the ground connection, the employee shall attach the other end of the grounding device to one side of an indicating device supplied for that purpose.

4. Test of Circuit

The normally live parts shall be tested with an electroscope or other approved device for detecting the existence of any difference of potential, keeping all portions of the body at the distance from such parts required by the rules under section E.

Only approved insulating rods of proper length shall be employed for bringing the testing device near current-carrying parts.

5. Completing Ground

If the testing device gives no indication of a difference of potential, the free end of the grounding device may be brought into contact with the normally live part and securely clamped thereto.

In making this contact it shall be done by means of a remote control switch or by handling the device by a suitable insulating handle and keeping all portions of the body well below and at a safe distance from the normally live part until the first contact is actually made.

6. Piercing Insulation

Where the protective ground can be made without penetrating any insulating covering, this should be done. If such insulating covering, however, must be pierced, a special device with insulating handle of proper length must be employed, and insulation pierced, to provide the point on which the ground can be made. At such times goggles should always be worn to protect the eyes and insulating gloves to protect the hands.

7. Removing Ground

In removing protective grounds 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.

Part III.—SPECIAL RULES FOR EMPLOYEES

I. POWER-STATION OPERATION

Engineers, machine attendants, and helpers shall study and strictly observe the following rules, in addition to all the general rules of Part II.

1. Care About Machines

Do not allow oil cans, tools, and wiping cloths to catch in moving parts of machinery. In passing any machine in operation be careful not to touch it or to allow tools or other pieces of metal to touch the machine or its connections. Do not use iron or tin oil cans near field magnets. Use only oilers and wipers with insulated handles on commutators, switches, and other electrical equipment.

2. Loose Clothing

Avoid loose clothing about moving parts of machinery and shoes that slip easily on the floors about live or moving parts.

3. Care About Live Parts

Do not work on or near exposed live parts unless authorized to do so, and then strictly observe the rules under sections C and E.

4. Handling Fuses, Switches, and Brushes.

In handling fuses or switches use only the insulating handles or the special rods or tongs provided. Never replace or remove link fuses from live terminals, nor remove or replace brushes on live equipment.

In handling voltage transformer fuses use the insulating rods or tongs and stand on the insulating platforms or mats provided.

5. Killing Parts Worked On

Do not work on any normally live part or moving part in assurance that it is not alive or will not move, unless you have first protected yourself against danger by having the live or moving part killed.

6. Nonroutine Work

Before doing any work other than regular station operation about exposed live or moving parts secure special authorization from the chief operator.

7. Open Flames

Do not smoke or bring open-flame devices into storage-battery rooms.

8. Use Goggles

When working where your eyes may be injured by arcing or by flying particles, wear noninflammable goggles.

9. Elevated Positions

When working in an elevated position, keep tools and materials not in use in proper receptacles, and do not drop tools or materials.

Do not work above live or moving parts unless necessary.

Assure yourself of the security of your position and support before proceeding with work.

10. Report Defects

Promptly report any broken or unsafe tools, defective safety appliances, or apparatus, or any dangerous condition of equipment or surroundings to your superiors.

J. SWITCHBOARD OPERATION

Switchboard operators, attendants, and helpers shall study and strictly observe the following rules in addition to all the general rules of Part II.

1. Do Not Open Secondaries

In handling instrument circuits, never open the secondary of a current transformer.

2. Care About Live Parts

Do not work on or near exposed live parts unless authorized to do so, and then strictly observe the rules under sections C and E.

When working near fuses and circuit breakers, be careful to avoid injury from their operation. If the hands are exposed to flashes, wear insulating gloves.

When working on one section of a switchboard or in one compartment, mark it conspicuously, and place barriers to prevent accidental contact with other sections or entrance into other compartments.

3. Killing Parts Worked On

Do not work on any normally live or moving part in assurance that it is not alive or will not move unless you have just assured yourself against danger by having the parts killed by the methods under sections F and G.

4. Handling Switches and Fuses

Do not open manual cutouts which are not designed for opening loaded circuits, unless the circuit has first been opened at a proper cutout.

When operating manual cutouts, keep the body as distant and as far below as possible and use only one hand.

In handling fuses or switches use only the insulating handles or the special rods or tongs provided. In handling voltage transformer fuses always stand on insulating mat or platform.

Never replace or remove link fuses from live terminals.

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

5. Protecting Others

Do not report lines or equipment dead for other men to work on until the lines or equipment have been cut out by air-break manual cutouts, protective grounds have been applied to the parts so cut off, and "Men at work" tags have been attached to the cutouts.

Also, in reporting, identify the parts by position, letter, or number, as well as by description.

6. Report to Chief Operator

Report to the chief operator any unusual conditions of load, the opening of any automatic cutout, and the indication of any ground on a normally ungrounded outgoing circuit.

7. Closing Circuits

Do not again close circuits above 750 volts, which have automatically opened immediately after each of three consecutive closings within ten (10) minutes, without special instructions from the chief operator.

Do not again close any circuit opened by automatic cut-outs if persons are known to be working on the circuit.

8. Handling Switchboard Equipment

All metal parts of equipment 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.

9. Accidental Grounds.

When an accidental ground is indicated on a normally ungrounded circuit, immediately open the circuit. If upon a trial closing, you find that the accidental ground still exists, open again, and do not again close without special instructions by the chief operator.

10. Elevated Positions

When working in an elevated position, keep tools and materials not in use in proper receptacles, and do not drop tools or materials.

Do not work above live or moving parts unless necessary.

Always assure yourself of the security of your position and support.

11. Report Defects

Promptly report to your foreman any dangerous condition of equipment, lines, or surroundings, including defective tools, switches, brushes, or protective devices, or live cases of apparatus.

K. OVERHEAD LINE OPERATION

Linemen and assistants, and groundmen, in construction, extension, removal, and repair work, shall study and strictly observe the following rules, as well as all the general rules of Part II.

1. Test Poles Before Climbing

Before climbing poles, ladders, scaffolds, or other elevated structures, first assure yourself that the pole, ladder, scaffold, tree, cross-arm, boatswain's chair, or other elevated support is strong enough to safely sustain your weight and that of the work to be done.

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

When poles or cross-arms are apparently unsafe from decay or unequal strains of wires on them, they must be properly braced or guyed before climbing.

2. Use Pole Steps

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

Do not support yourselves by pins, brackets, cross-arm braces, or wires.

3. Tag Circuits Worked On

Do not work on or about overhead lines until authorization has been given by the chief operator and he has stated whether the section to be worked on is dead or alive, and that the circuit is tagged at the proper points to show that it is being worked on.

In all such statements identify the lines on or about which work is to be done by position, letter, or number as well as by description.

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

4. Care About Live Parts

Leaning over and crowding through wires must be avoided. Place yourself so that you will not fall on wires should an accident occur.

Handle switches and fuses only by means of the special insulating handles, rods, or tongs provided.

5. Safety Belts

When on poles support yourself with both hands, unless you are secured in position by an approved safety belt or other adequate means.

6. Do Not Open Series Circuits

Never open a series circuit; always connect a jumper across any arc lamp or loop in such a circuit before working on it.

7. Treat as Alive

Do not depend on the insulation of wires, and treat all lines as alive unless they have been killed by the method under section F.

Treat as alive all lines (unless thoroughly grounded) which are being strung near power lines; regard them as being of the same potential as the power lines.

8. When Touching Live Parts

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

While touching power lines or equipment, avoid touching ground wires, guy wires, span wires, metal pipes, metal sheaths, signal lines or equipment, metal fixtures on poles, or metal poles.

While touching signal lines or equipment, metal sheaths, metal pipes, ground wires, or metal fixtures on poles, avoid touching power lines or equipment, guy or span wires.

9. Protecting Traffic

When working overhead, keep tools and materials not in use in proper receptacles; do not throw tools or materials to the ground, but lower them.

When working overhead, or hoisting or lowering materials above spaces where traffic occurs, you must have a man stationed to warn passers-by.

Workmen must not stand where they can be struck by materials dropped by men working overhead.

10. Stringing Lines

Never string lines above live lines operating at over 7,500 volts.

Never change the strains on a pole by adding or removing lines, unless you have assured yourself that the pole is equal to the altered strains.

11. Report Defects

Report promptly to the chief operator any dangerous condition observed such as defective insulators, pins, cross arms, sagging wires, etc.

12. Crossed or Fallen Wires

When you find crossed or fallen wires, remain on guard and have the chief operator notified. Only when authorized by him, may you correct the condition.

13. Applying Grounds

In applying a grounding device, attach it first to the ground connection, and then to the parts which are to be grounded.

In removing such a device, it must be removed from the ground connection last.

L. ARC LAMP OPERATION

All arc-lamp trimmers, hangers, and inspectors must study and strictly observe the following rules in addition to the general rules of Part II, and the special rules under section K.

1. Climbing Ladders

Never climb a ladder unless it is well secured from slipping at both upper and lower ends.

2. Always Bridge Arc Lamps

Before working on arc lamps in series circuits, bridge them at cutouts or otherwise, so that the circuit can not be opened at the lamp.

3. Chief Operator's Authorization

Do not begin work until you have received authorization from the chief operator and his statement whether the lines are dead or alive, and you have identified the lines to be worked on by position, number, or letter, as well as by description.

4. Handling Arc Lamps

Trimmers must not handle any arc lamp until it has been disconnected from its circuit by an absolute cutout.

Trimmers must wear suitable insulating gloves and stand only on insulating platforms or dry well seasoned wood poles, while touching arc lamps or their cutouts.

5. Handling Lamps Alive

Inspectors (or trimmers acting as inspectors) must not handle any live lamps, except upon special authorization to work on them in that condition, and shall then observe the rules applying under section E.

6. Report Defects

Report promptly to the chief operator any sagging wires, broken insulators, leaning poles, broken globes, lamp supports, and other dangerous condition observed about lines.

M. UNDERGROUND OPERATION

All cable splicers and other workmen in underground construction or operation must study and strictly observe the following rules in addition to the general rules of Part II.

1. Notify Fire Department

Before opening manholes where traffic may be obstructed, have the fire department notified.

2. Test 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 method.

3. Barriers at Manholes

When removing manhole covers in places where traffic occurs, promptly surround the opening with a barrier guard, and display danger signals or red lights from two sides of the barrier at right angles to the direction of traffic.

4. Watchman at Surface

Do not enter manholes unless a man is stationed at the surface.

Do not leave manholes unwatched until the manhole covers have been replaced and fastened in position.

5. Avoid Flames

Do not smoke or use open flames, matches, or torches in or near manholes. Approved safety lanterns only may be used.

Avoid sparks in handling live parts or cable sheaths and avoid igniting soldering flux in soldering and wiping joints.

6. Authorization

Do not begin work about lines until you have received authorization from the chief operator and his statement whether the lines are alive or dead; and have identified the lines to be worked on by position, number, or letter, as well as by description.

If lines and cables are not properly identified by markings, you must not work upon them.

Always test cables with the test devices provided, before piercing the cable sheaths.

7. Splicing Live Cable

Do not splice live cables operating above 750 volts.

8. Report Defects

Promptly report any dangerous condition to the chief operator, whether observed in underground or overhead construction. Particularly report insanitary condition, gas or missing cable tags in manholes, and sagging wires or broken supports in overhead construction.

9. Guard Fallen Wires

When you find crossed or fallen wires in overhead construction or gas leakage from manhole cover, remain on guard and have the chief operator notified without delay. Only when authorized by him may you correct the condition.

N. METER OPERATION

All meter setters and adjusters must study and strictly observe the following rules in addition to all the general rules of Part II.

1. Taped Joints

Never leave joints or loose ends of wires untaped.

2. Do Not Open Series Circuits

Do not open the secondary circuit of a current transformer, but short-circuit it, before changing connections.

3. Care About Live Parts

When handling live parts you must observe the rules under sections C and E.

Do not use bare fingers or hands to determine whether the circuit is alive. Never remove or replace fuses in live circuits except with approved appliances.

4. Open Circuits at Switches

Do not open circuits at meter connections, until the circuits have been first properly opened at manual cutouts.

5. Special Tools

Use only the special hand tools provided, and so reduce the danger of short circuits.

6. Goggles

When working where the eyes may be injured by arcing, wear non-inflammable goggles with suitable glasses.

7. Report Defects

Promptly report to your foreman any live meter case, or any condition of a meter, of its connections, or of overhead lines, which might endanger life and property.

8. Guard Fallen Wires

When you find crossed or fallen wires remain on guard and have the chief operator notified without delay.

O. TESTING OPERATIONS

All electrical testers, helpers, and others working about electrical tests, must study and strictly observe the following rules in addition to all the rules of Part II.

(NOTE.—Owing to the diversified character of testing work this study must usually extend also to the special rules of Part III.)

1. Authorization

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 under section D.)

2. Check All 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.

3. Local Foreman

One properly qualified person must be in immediate charge of all testing work.

4. Warnings and Barriers

Display danger signs and erect barrier guards about all equipment or lines under test, when in places where traffic occurs.

5. Two Men

No person shall work unaccompanied in testing or experimental work on or about parts on which the voltage can exceed 750 volts.

6. Avoid Flashes

When working near automatic cut-outs keep faces and eyes turned away to avoid possible flashes. If necessary to remain where eyes are exposed by automatic cut-outs, wear suitable goggles.

If hands may be exposed, wear insulating gloves.

7. Report Defects

Promptly report to the person in charge any condition of equipment or lines under test which may endanger life or property.

P. SIGNAL LINE OPERATION

All men working on or near overhead or underground telegraph, telephone, police, fire, district messenger, or other signal lines must study and strictly observe the following rules, in addition to all the general rules of Part II, sections C, D, and E, and the special rules of Part III, section K.

1. Official in Charge of Operation

In those rules where the words chief operator are used you are to understand them as referring to the wire chief or other official in charge of operation.

2. Before Climbing Poles

Before climbing poles or other structures to work on or about signal lines, ascertain whether power lines are carried on or near the structure or cross the adjacent spans.

If such power lines exist, do not proceed with work until instructions for your protection are received from the wire chief or other designated official and you have complied with such instructions.

3. Approaching Power Lines

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

Do not approach any power line or power equipment within the distances given in rule 2, "Extra high potential," or in rule 3, "High potential," under the section E, "Handling live equipment and lines," unless you comply with all the rules under that section.

4. Touching Equipment

While handling signal lines, metal sheaths, or other signal equipment, avoid touching power lines or power equipment, guy wires, or span wires.

5. Telephone and Signal Boxes

When signal lines are carried on the same poles with power lines, before using telephones or signal boxes, while standing on ground or other conducting platform, insulate yourself from the ground by means of the special insulating platforms, or mats, provided.

6. Stringing Wires

When stringing wires or cables over or under power lines, the lines being handled shall be treated as alive and you must carefully observe the rules under section E.

7. Report Dangerous Conditions

Promptly report sagging wires, broken insulators, pins, cross arms, leaning poles, or any dangerous conditions on or near your lines to the wire chief.

8. Crossed or Fallen Wires

When you find crossed or fallen wires, remain on guard and have the wire chief notified. Then await his instructions.

Q. TUNNEL AND SUBWAY OPERATION

Tunnel and subway electricians, operators, and others working on or about underground electrical equipment shall study and strictly observe the following rules, in addition to the general rules of Part II, sections C, D, and E, and Part III, sections I and M.

NOTE.—*Dangerous locations.*—The value of insulation as protection from shocks is reduced by the dampness usually present in these and similar locations. The restricted spaces necessarily bring wires and equipment closer to workers 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.

1. Live Electrical Parts

Before handling any electric wires or equipment, make sure whether they are alive or not. It is not advisable to work on live wires or equipment when the current can safely be shut off.

2. Touching Live Parts

Never touch or disturb any electrical wires or equipment without being authorized by the chief electrician in charge. It is dangerous to fool with live wires. Never enter an electric-motor room, or interfere with its operation, unless authorized to so so.

3. Standing on Ground

Do not touch any electric wire, cable, or third rail, no matter how well it is insulated, while standing on the ground or on any pipe, track, rail, or other conducting surface, unless you are insulated from the latter. Also avoid slipping and stumbling while near wires or third rail.

Remember that damp ground and water are conducting surfaces.

Insulation on a wire may look perfect but can not be relied on to prevent shock.

4. Metal Frames

Do not touch the metal frame or case of a motor unless you are insulated from the ground, or the frame is effectively grounded.

5. Carrying Tools

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

In particular, do not carry such objects on the shoulder when there bare wires overhead. Do not carry objects on that side of the passageway where third rails are exposed.

6. Repairing Live Parts

When necessary to handle or repair live trolley wires, third rails, cables, motors, or other electrical equipment, wear suitable insulating gloves and stand on the waterproof insulating mats or platforms provided.

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

7. Insulation on Cables

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

Inspect trailing cables at least once daily during the period of their use.

8. Handling Portable Devices

In handling portable motors or lamps, first make sure that any external metal parts are 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.

9. Fuses and Switches

Never handle fuses or close manual cutouts unless you are authorized to perform that special duty.

Before closing switches, first make sure that you are not endangering others.

Never handle fuses or switches except by means of the insulating handles or rods provided.

10. Jumping On or Off Cars

Never get on or off locomotives or cars on the trolley wire or third-rail side.

11. Combustibles and Explosives

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

12. Injuring Cables and Wires

Do not fire shots, handle tools, or perform other work in such a manner as to injure cables or wires in the vicinity. If in doubt, consult the chief electrician.

13. Explosive gases

Do not open any cases inclosing motors, switches, or fuses if any explosive gas is present.

14. Temporary Circuits

Never arrange the wiring of any temporary circuits for ground return. This particularly includes shot-firing circuits and cables to portable motors and lamps.

15. Report Dangerous Conditions

Report any dangerous or unusual conditions observed to the proper authority. In particular, report the presence of gas, sagging wires, broken insulators, bad insulation on wires, defective third-rail construction, live frames of motors, broken ground wires on motor frames, and sparking or arcing noticed at any point.

Report also any fallen or crossed wires, whether electrical wires or not. This includes trolley wires at partings and crossings and wires injured by falls of the roof.

16. Guard Fallen Wires

When you find fallen wires remain on guard to warn others, unless you are equipped to safely repair the defect.

APPENDIX

ORGANIZATION AND CONDUCT OF SAFETY WORK

In rules A 6, 7, and 8 for the employer, and in many of the foregoing rules for employees, the familiarity of the employee with the prescribed safe methods of performing his duties is emphasized as a prime factor in his qualifications. Rules can be effective only in proportion as they are understood and observed, and safety rules must be thoroughly comprehended and intelligently followed, if the much-desired results in accident prevention are to be secured. The spirit of accident prevention also must be manifested constantly by employer and employee alike to assure the consistent observance of the established rules.

It is not considered wise at this time to include in the foregoing safety rules, requirements governing the means to be adopted for securing this familiarity on the part of employees with safe operating methods, and for developing the accident-prevention spirit. The most effective means will depend upon the size and character of the operating organization and upon its personnel.

Experience, however, has abundantly demonstrated the effectiveness of well-planned safety-committee work both in instructing employees and in securing their hearty cooperation, and this idea has received cordial indorsement by many employers and employees.

From the replies of about 700 electrical utilities, operating in cities of over 5000 population, it appears that the use of some form of safety committee or bureau activity has been made by less than 50, and many even of this number report no systematic plan. (Such organizations are more common in manufacturing industries.) From the replies, however, it is evident that most of these utilities are desirous of forming safety committees on some definite plan, and of adopting adequate safety rules.

In considering a plan of safety organization adapted to the needs of electrical work, and particularly to electrical utilities, there are available for study the plans of several such organizations already in successful operation, and the excellent recommendations of the 1913–14 committee on

accident prevention of the National Electric Light Association, which resulted from the study of a large number of the safety-committee plans at present in use. The following is substantially the plan outlined by the National Electric Light Association committee in its folder entitled "How to Organize and Carry on a Campaign for the Prevention of Accidents":

NATIONAL ELECTRIC LIGHT ASSOCIATION RECOMMENDATIONS

Organization.—The active interest of the management is very essential for the success of safety work, and where possible it should organize a department to supervise the carrying on of the work.

The company should announce the proposed plans to the employees and call a meeting for the general discussion of the subject.

After such discussion and full explanation of plans, a general safety committee should be appointed. This committee should be permanent and should be composed of department heads or other responsible officials, whose experience qualifies them to pass upon the causes of accidents and recommend measures for their prevention. Every department where the likelihood of accident is considerable should have a representative on this general committee.

The safety committee may then appoint several subcommittees, to serve for periods of not longer than one year, and if sufficient enthusiasm is developed among the employees of the different departments appointments to these subcommittees will be sought by the men.

In organizing the safety department and the various committees it should be borne in mind that the most important asset for the successful carrying on of the work lies in gaining the interest and cooperation of every employee.

Many companies by virtue of their smaller organization will be unable to carry on all of the work in just the way outlined above. However, the necessity for having some definite plans for promoting safety is none the less with such companies.

The suggested plans permit of modification to meet local conditions; the manager himself may become the head of the safety department, and the employees his assistants.

Method of procedure.—A careful study should be made of all accidents occurring. A uniform report blank should be adopted and complete data kept as to the cause and result of injuries, time of disability, etc., with a view of enabling safety committees to make such recommendations as may prevent the recurrence of similar accidents.

The committee should make inspections and reports, pointing out features of construction and operation which in their opinion are unsafe. Every employee should be encouraged to make suggestions regarding the correction of defects, each

acting as an inspector in his particular line of work. A prize contest for suggestions has been found an excellent incentive in many companies, and is recommended as worthy of consideration.

Frequent meetings with the men should be arranged, at which time full information should be given as to accidents, so as to bring out discussion on means of avoiding such accidents. The question of first aid to the injured should be taken up in a thorough manner and practical demonstrations given on methods for handling various emergencies.

Plans closely related to those outlined above are effective with an increasing number of companies, and as instances of safety-committee work adapted to larger and smaller operating organizations, a few of those recently presented to us by the companies employing them are cited below.

UNION ELECTRIC LIGHT & POWER CO., ST. LOUIS

The safety work is carried out by means of a central safety committee, consisting mainly of the heads of departments in which accidents are most likely to occur, and subcommittees, comprised of foremen and men in the various departments, the total number of men on the committees consisting of about 80 in an organization of 1000. It is the intention to change the personnel of the subcommittees practically every six months, in order to have the safety idea thoroughly instilled throughout the organization.

The work of the committees is divided into four parts, as follows:

1. Analysis and discussion of accidents that have happened, with the object of preventing their repetition.

2. Analysis and discussion of circumstances and conditions under which accidents might happen, in order to keep down the number of preventable accidents.

3. Recommending the installation of safety devices, with a view of preventing accidents.

4. Passing upon matters of standard practice, with safety in mind.

All recommendations made to or by the central committees are referred to the general manager of the company. In this manner the committee keeps in close touch with the management.

Suggestion cards for the prevention of accidents are issued to all employees. The object of these cards is to give the rank and file an opportunity to point out unsafe practices and make recommendations of a safety nature. These cards when received with suggestions from employees are turned over to the central committee.

NEW YORK EDISON CO., NEW YORK

The general safety committee consists of a representative from each department and ex officio the claim agent and the safety engineer, the last named acting as permanent chairman.

Each member of the general safety committee chooses a departmental subcommittee, of which he is to be chairman.

This departmental subcommittee is representative of the several classes of work conducted by its department and is assisted by an auxiliary committee of 10 per cent of the men employed in the department whose duties are chiefly that of observation in the field.

This gives practically all employees the opportunity of making recommendations for improvement in safety work or expressing their ideas relative to bettering the conditions under which they labor.

COMMONWEALTH EDISON CO., CHICAGO, ILL.

The purpose of the organization is to prevent accidents by securing the cooperation of the employees of the company, by affording them an opportunity for the discussion of safety work, and by organizing, instructing, and interesting them in methods of performing their work with the greatest safety to the public and to themselves.

The safety organization shall consist of (*a*) the central committee on safety; (*b*) intermediate safety committees; (*c*) employees' safety organizations.

The management of the company has arranged a central committee on safety, consisting of 16 members. This central committee confers directly with five of the employees' safety organizations as follows: testing department employees; building maintenance employees; engineering distribution employees; Chicago Stone Conduit Co.; Illinois Maintenance Co.

Through six intermediate safety committees the central committee on safety confers with other employees' safety organizations. The names of the six intermediate safety committees and the membership of such committees are as follows:

	Men.
Power Plant Division	18
Street Division	15
Substation Division	14
Stores Transportation	12
Service Division	15
Construction Division	18

The employees' safety organizations which confer through the intermediate safety committees are as follows:

Power Plant Division.—Fisk Street turbine room; Fisk Street boiler room; Quarry Street turbine room; Quarry Street boiler room; Fisk-Quarry electrical men; Fisk-Quarry building and yard men; Northwest generating station; Generating stations Nos. 10, 11, and 12; Grove Street generating station.

Street Division.—Street department north; street department west; street department south; street department cable; street department conduit.

Substation Division.—Substation chief operators; substation operators and apprentices.

Stores Transportation.—Stores department employees; transportation department.

Service Division.—Meter department, office and maintenance; meter department, office and shop; arc and repair, central and west; arc and repair, northern; arc and repair, southern; lamp renewals and etching.

Construction Division.—Interior wiring, Sw.–W.–Nw.; interior wiring, central and Se.; interior wiring, southern; station construction, central and Sw.; station construction, W.–Se.–N.; station construction, northern; station construction, shops.

LEXINGTON UTILITIES CO., LEXINGTON, KY.

An officer of the company holds a meeting once a month with a committee of employees. This committee consists of men from the track department, car-barn department, power-house department, line department, and the representatives of conductors and motormen and ice department. They formulate certain recommendations which are sent around to the heads of the different departments in the form of typewritten communications. The head of each one of these departments is requested to see that these requests are carried out as far as possible.

MENOMINEE & MARINETTE LIGHT & TRACTION CO., MENOMINEE, MICH.

The safety organization consists of a central safety committee and department safety committees.

The central safety committee consists of the general manager as chairman, general superintendent as vice chairman, a secretary, and the foremen of the several departments. This committee meets twice a month to discuss safety matters and pass on the safety suggestions coming from the department committees and employees.

The department committees are made up of two or more employees from each department. The department committees make a thorough inspection of their

departments once a month and report their findings and suggestions to the chairman of the central committee. The department committees are given whatever time is necessary to make this monthly inspection, and such time is paid for at the regular rate.

The department committees meet with the central committee once a month.

ADVANTAGES OF SAFETY CAMPAIGNS

Beyond the large immediate value of safety-committee work in accident prevention, it is proper to recall also the distinct advantages which should accrue from safety-committee work through the better relations between employer and employee fostered by such activities, and through the increase in individual efficiency resulting from its educational features, such as lectures, discussions, and reports. The cooperative spirit is usually found to be greatly stimulated by safety work, and to be reflected in the pleasanter and more efficient conduct of the entire plant operation.