THE PENNSYLVANIA RAILROAD

C. T. 290

ELECTRICAL OPERATING INSTRUCTIONS

Revised
December 15, 1966
NAME: W. Wessie

OCCUPATION: Snowmaster
THE PENNSYLVANIA RAILROAD

ELECTRICAL OPERATING

INSTRUCTIONS

REVISED
NOTICE

The instructions herein set forth are issued for the protection of employes and property and operation of trains and engines in electrified territory and must be observed by all employes whose duties are in any way affected thereby. They supersede all previous instructions inconsistent therewith.

A copy must be issued to all employes working regularly or intermittently in electrified territory. Each new employe must be furnished a copy before he is assigned to duty.

Each employe whose duties are in any way affected by these instructions must have a copy with him while on duty.

Receipt must be signed by each employe receiving these instructions and forwarded to the Superintendent.

G. C. VAUGHAN,
General Manager, Eastern Region.

Approved:
J. B. JONES,
Vice President, Engineering & Real Estate.

A. M. HARRIS,
General Manager, Transportation.

W. E. LEHR,
Chief Mechanical Officer.
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GENERAL INSTRUCTIONS

Safety is of the first importance in the discharge of duty.

Employes must be conversant with and obey these instructions. Obedience to them is essential to safety. Constant care must be exercised to guard against personal injury, loss of life, or damage to property. Employes must be familiar with the illustrations and instructions for resuscitation from electric shock. If in doubt as to their meaning, employes must apply to the proper authority for explanation.

All occurrences or conditions which are likely to affect electric operation must be reported immediately to the Superintendent.

Employes in electrified territory must be familiar with the location and operation of telephone apparatus.

When necessary to deenergize overhead wires or third rail to prevent loss of life or damage to property, Power Director must be notified immediately, and person so notifying Power Director shall await his instructions. Power Directors are located at New York, Philadelphia, Harrisburg and Baltimore. Employes working on or near energized wires must obtain permission and proper protection from Power Director. Conductors and Enginemen are responsible for knowing that crew members and Foremen are responsible for knowing that their men understand and comply with instructions for electrical operation. When inexperienced employes are required to work in electrified territory, experienced employes must call their attention to the danger.

During periods of extreme high or low temperatures, due to hot or cold weather conditions, extra precautions must be taken by making additional inspections, as required, to determine that the catenary system is in proper alignment.
GENERAL DEFINITIONS

Electrified Territory. That portion of the railroad equipped for electric train operation by catenary system or by third rail, and necessary substations, transmission, and signal power lines located above or adjacent to the tracks.

Power. Electric energy, commonly referred to as "power," is produced at central generating stations or power plants and transmitted at high voltage by means of transmission lines to substations where it is distributed to overhead catenary system, third rail, signal power lines, etc.

Energized—Live (Dangerous to Life). Electric apparatus, such as overhead wires, third rail, transformers, switches, motors, etc., is energized when connected to a power source.

Deenergized—Apparently Dead. Electric apparatus, such as overhead wires, third rail, transformers, switches, motors, pantographs etc., is deenergized when disconnected from the normal power source, but such apparatus is dangerous to life until properly grounded.

Ground—Earth Connection. Electric apparatus, such as overhead wires, third rail, transformers, switches, motors, etc., is grounded when metallically connected to the earth.
**Circuit.** The complete path over which electric current is transmitted from and returned to its source.

**Transmission Lines.** A system of wires or cables, or both, used to transmit power at high voltage between central generating stations and substations.

**Substation.** A location where power is received at high voltage and changed to required voltages and characteristics for distribution to the catenary system, third rail, and other electric apparatus. It may contain transformers, rotating machinery, circuit breakers, sectionalizing switches, rectifiers, etc.

**Transformer.** Apparatus which serves to increase or decrease voltage.

**Catenary System.** A system of wires suspended between poles and bridges supporting overhead contact wires normally energized at 11,000 volts.

**Circuit Breaker.** A device which operates automatically or manually to protect or to energize or deenergize transmission lines, signal power lines, catenary system, third rail, etc.

**Sectionalizing Switch.** A device which is closed to energize or connect and opened to deenergize or separate a section or sections of the catenary system, signal power lines, third rail, etc.
Figure 3  Third Rail

**Contact (Trolley) Wire.** The overhead wire, sometimes referred to as trolley wire, from which the pantograph collects current.

**Section Break.** A location where overhead wires are arranged to provide separation of circuits and to permit continuous collection of current.

**Phase Break.** A location where overhead wires are arranged to provide an insulated section between different sources of power.

**Dead Section.** A section of overhead wires deenergized whose limits are designated by dead section signs—DS at locations specified in the timetable.

**Third Rail.** An electric conductor located alongside the running rail from which power is collected by means of a sliding contact shoe attached to the truck of electric equipment.

**Grounding Switch.** A device which is closed to connect wires or electric apparatus metallically to the earth.

**Arc.** A luminous and destructive flash or flame in or about the wires, third rail, or electric apparatus.

**Electric Equipment.** Electric equipment, as used herein, refers to engines and cars operated by power received from an overhead contact wire or a third rail.

**Pantograph.** A device located on top of electric equipment which collects power from the overhead contact wire by means of a sliding contact shoe.

**Bus Jumper.** A cable or jumper used to transmit power from one unit of electric equipment to another.
Control Jumper. A multi-circuit cable or jumper used between engines or multiple-unit cars to transmit control.

Superintendent. As referred to in these instructions, the Superintendent will be represented by the Train Dispatcher.

Load Dispatcher. The load dispatcher is in charge of the electric power supply system.

Power Director. The power director is in charge of power distribution.

Qualified Employes. Employes who have passed the required examinations and have been approved by proper authority are classified as follows:

CLASS A.—Employes competent to erect, repair, and maintain electric apparatus, or to supervise and protect other persons performing work in electrified territory.

CLASS B.—Employes, such as trainmen, enginemen, car inspectors, and other approved employes in electric service, permitted to go on top of high equipment under the conditions hereafter authorized in these instructions.

CLASS C.—Employes, such as Supervisors, Assistant Supervisors, M.W. Foremen, Bridge and Building Foreman and qualified Crane Operators, Machine Operators and Engineers Work Equipment in Maintenance of Way Service under the conditions hereafter authorized in these instructions.
ELECTRICAL INSTRUCTIONS

Energized (Live) Circuits

1. Tracks equipped for electrical operation are specified in the timetable.

2. All overhead wires must be considered energized (live) at all times except when it is known they have been deenergized and properly grounded.

3. Until after wires are deenergized and properly grounded, and protection afforded by a Class A employee, all persons excepting Class A employees must not approach within the following distances:
   - Of transmission wires: eight (8) feet
   - Of catenary system: three (3) feet
   - Of signal power wires: three (3) feet

4. The third rail must be considered energized (live) at all times except when it is known to be deenergized.

5. Tools, clothing, or any part of the body must not be brought in contact with the energized third rail, except under the supervision of a Class A employee. Contact must never be made between the energized third rail and the track rails or ground, except with properly insulated tools under direction of Class C employee. The protection board over the third rail must not be used as a walkway.

Damaged Wires, Third Rail, Attachments, or Supports

1. The following conditions which are likely to affect electric operation must be reported immediately to the Superintendent.
Broken or loose wires.
Attachments out of place.
Broken overhead or third rail insulators.
Foreign objects (including kite strings).
Splintered cross arms.
Loose third rail joints.
Broken or loose protection boards.
End approaches out of place.
Splintered side approaches.
Defective anchors.
Buckled third rail.
Other abnormal conditions.

In describing such conditions the proper names and locations of the parts involved should be used as shown on pages 6 to 12.

2. Employees must not touch dangling wires or foreign objects hanging from such wires nor attempt to move them by any means, but must report their location immediately to the Superintendent and should, if possible, leave some one to provide protection for other persons.

3. Loose or broken impedance bond connections in the tracks must be regarded as energized (live) and reported immediately to the Superintendent.

4. When an overhead wire failure occurs that may obstruct tracks, all tracks that may be affected must be protected immediately.

5. When a broken wire or obstruction in overhead catenary is found which may damage a pantograph, a signal must be given approaching electric equipment on
track involved by swinging a hand, flag, or lamp vertically in a circle at arm’s length across the track.

**Hand, Flag and Lamp Signals**

**Manner of Using**

Swing vertically in a circle at arm’s length across the track on which the electrical equipment is approaching.

**Indication**

Drop pantographs immediately.

When this signal is received, it shall be acknowledged at once by two short sounds of the engine whistle and pantographs must be dropped immediately. After passing the break or obstruction, pantographs may be raised.

**Pantographs**

1. Pantograph poles are carried on all a-c electric engines and a-c multiple unit cars and are located at all block and interlocking stations. Rubber gloves are carried on all electric engines and are located at all block and interlocking stations. After use, the pantograph poles and rubber gloves should be returned to the proper receptacles and report made of their use to the Superintendent.

2. Condition of pantographs should be observed frequently. In case of a defective pantograph, report should
be made to the Superintendent. Enginemen are responsible for taking corrective action when it is necessary.

3. Under normal operation of single or coupled electric engines, rear pantograph shall be up on each engine except class E-44, which must have the leading pantograph up. Adjacent pantographs of coupled engines should not be up when it can be avoided. The number of electric engines coupled and in service will be governed as follows:

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<td>None</td>
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<td>5</td>
<td>50 m.p.h.</td>
</tr>
<tr>
<td>6</td>
<td>Not exceed 35 m.p.h.</td>
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<tr>
<td>Over 6</td>
<td>Prohibited</td>
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4. When there are visible defects or obstructions that may damage pantographs, pantographs must be dropped.

5. When pantograph frames, shoes, or end horns show indications of having been struck, pantograph must be dropped and electric equipment stopped at the nearest telephone, where conditions shall be reported to the Superintendent.

6. When pantographs are broken or damaged, electric equipment must be stopped immediately and arrangements made to deenergize wires over the equipment. If broken or damaged pantograph fouls the overhead wire, it must be disengaged with the pantograph pole.

7. During periods of high wind, enginemen will observe action of pantograph and catenary to the extent practical, and when it appears that damage may occur or that slower speed would be more desirable, he will reduce his speed at once and report to Superintendent for instructions at the first point of communication.

8. Where two pantographs are located on one unit they are electrically connected; therefore the pantograph that is in the down position is energized (live) by the one in the up position.

9. Class A and B employees may go on the roof of electric equipment and remove or secure broken pantograph after:

   (a) Overhead wire has been deenergized.

   (b) Overhead wire has been grounded by raising undamaged pantograph and closing manual grounding switch on the same unit or on coupled units. When possible additional protection should be
provided by raising undamaged pantographs and closing manual grounding switches on units ahead and following damaged equipment.

(c) Position of all overhead wires has been noted.

(d) Standard warning tag MP 397, properly filled out, or approved personal danger tag has been applied to handles of all grounding switches closed for protection.

After all persons have descended from the roof of electric equipment

Standard warning tags MP 397 or approved personal danger tags must be removed by persons who applied them before grounding switches are opened.

10. Electric equipment must not be moved until all broken pantographs have been removed or properly isolated and secured so that no part can come in contact with overhead wires or with equipment on adjacent tracks.

11. Controller must be placed in OFF position before pantograph is dropped.

12. Pantograph should not be raised when equipment is adjacent to turnout or crossover to prevent bouncing of wires over adjacent tracks.

13. When it is necessary to raise or drop pantographs from the outside of electric equipment by means other than compressed air, the pantograph pole must be used as follows:

(a) The pole must be clean and dry.

(b) Rubber gloves must be worn.

(c) Hands must not be closer than six (6) feet from the hook.

(d) Pole must be kept clear of clothing and body.

14. When necessary to keep pantographs down because of defective condition on engines or multiple unit cars, grounding switches must be fully closed and pinned, except that when such equipment is moved through North or East River Tunnels (New York Division), all grounding switches must be open and the following will govern:

Pantographs must be securely tied down with no part extending above locked down height, except when defective condition is other than damaged pantograph
and control air pressure is maintained in the down cylinder.

15. On multiple unit cars not equipped with master controller, a pantograph control switch is installed on the switchboard to lower the pantograph, in the same manner as pantograph down button operates on multiple unit cars equipped with master controller.

16. Multiple unit cars or engines must not be moved from electrified to non-electrified tracks or from non-electrified to electrified tracks unless pantographs are down, grounding switches closed and pinned.

Drop Pantograph Train Order

1. When catenary has been damaged and when it has been determined that electric equipment can be safely operated under such catenary provided pantographs are down, the Superintendent will issue a drop pantograph train order. Track involved and limits of territory through which pantographs must be kept down will be specified.

2. Before passing the block or interlocking station immediately ahead of the territory specified in the drop pantograph train order, all pantographs must be tested. When any pantograph fails to operate properly, electric equipment must be stopped and the condition must be immediately reported to the Superintendent.

3. When any pantograph fails to drop at limit specified in the drop pantograph train order, equipment must be stopped.

4. Speed of thirty (30) miles per hour must not be exceeded within the limits specified, unless otherwise stated in the drop pantograph train order.

5. When drop pantograph train order is in effect the pantograph DOWN button or switch should be left in the IN or DOWN position between the limits of the drop pantograph train order.

Renewing Pantograph Shoes

1. Pantograph shoes may be renewed under energized (live) catenary wires only at locations where contact wire is five (5) feet or more above the roof of electric engine or multiple unit car.

2. When renewing pantograph shoe at such location, the procedure outlined on the following page must be followed.
(a) Before going on roof or touching any part of pantograph assembly:

Full control air pressure must be obtained.

Battery switches must be closed.

Pantograph DOWN button or switch must be in the IN or DOWN position.

All pantographs must be down.

All grounding switches must be closed and locking pins inserted.

Pantographs must be held down by latches and grounding switches must be making proper contact.

The position of all overhead wires must be noted.

Standard warning tag MP 397 properly filled out, or approved personal danger tag must be applied to grounding switch handles.

(b) While working on the roof:

Keep at least three (3) feet from all wires.

Stand astride pantograph tubing so it cannot raise, but do not bear excessive weight on tubing which might throw it out of position.

Do not work directly under the wires.

Do not up end the pantograph shoe. Always lay shoe on pantograph tubing in a horizontal position and slide into or out of place.

Before descending, be sure that all pantographs are held down by latches, grounding switches are closed, and tools are removed.

(c) After all persons have descended from the roof:

Standard warning or personal danger tags must be removed from grounding switch handles by persons who applied them.

Keep as far as possible from all normally energized parts.

Open grounding switches.

Prepare engine or car for service.

3. Pantograph shoes must not be renewed under overhead wires at locations where contact wire is less than five (5) feet above the roof of electric engine or multiple
unit car until overhead wires have been deenergized and properly grounded.

**Working on Electric Engines or Multiple Unit Cars**

1. Work must not be done on any electric engine or multiple unit car under overhead wires except by or under the supervision of a Class A or B employe.

2. All electric engines and multiple unit cars under overhead wires must be considered energized (live) except when it is known that pantographs are down and grounding switches are closed (in) or that overhead wires are deenergized (dead) and properly grounded.

3. Work must not be done on any circuit of an energized multiple unit car except when the switch disconnecting that circuit is open. Fuses in heater circuit must not be replaced while pantograph is up.

4. An assigned employe must know that all pantographs are down and all hand operated grounding switches are closed before and during the time that the following work is performed on electric engines under overhead wires:
   
   (a) Sanding.
   
   (b) Renewing fuses unless otherwise provided in Instruction No. 204, Questions and Answers on Alternating Current Electric Locomotives, Alternating Current M. U. Cars and Oil Fired Boilers for Steam Heat.
   
   (c) Cleaning, wiping, or washing inside or outside of engines, except when pulling through washing machines.

5. Before any person starts to perform any such work as specified in the preceding, he must obtain permission from the assigned employe. After work is completed, the assigned employe must know that all persons are clear and have been properly informed before opening grounding switches.

6. Pantographs must be down before control jumpers for multiple operation are applied or removed. If not practicable to lower pantographs, open generator switch, battery switch, and air compressor switch during time of insertion or removal of jumpers.

7. Except as specified in these instructions, before any work is performed on or near energized circuits of coupled electric engines or coupled multiple unit cars,
pantographs must be down and grounding switches must be closed on all units between which control jumpers are applied.

8. When necessary to inspect or test single or coupled energized electric engines or multiple unit cars, a Class B employee must take charge and others assisting with such work must be governed by his instructions.

9. Repair work or cleaning on or near main power circuits on electric engines or multiple unit cars must not be performed under energized (live) wire until pantographs have been lowered, grounding switches have been closed, and personal danger tags have been applied by employees doing work or cleaning, except that personal danger tags may be applied only by employee definitely assigned to prepare engine or car for other employees to perform this work. In the latter case, other employees performing this work must obtain permission from assigned employee before starting work and must advise assigned employee when work is completed. Personal danger tags must be removed by employees who applied them. Grounding switches must not be opened until tags are removed and it known that all persons are clear of main power circuits.

10. Inspection and repair work on electric engines at engine terminals shall be performed in accordance with the following procedure:

(a) Under deenergized and grounded wire:

An assigned employee must deenergize and ground the overhead wire before any other employee may work on the engine, except when permanently grounded section is provided.

The assigned employee must place a blue flag or banner at the entrance to the inspection pit and each employee must place his personal danger tag on blue flag or banner before starting to work.

When his work is completed, each employee must remove his personal danger tag.

After all personal danger tags are removed, the assigned employee must know that all persons are clear before he removes the blue flag or banner.

Assigned employee may then remove ground and energize the overhead wire, except when dead section is provided.
(b) Under energized (live) wire:

An assigned employe must lower the pantographs and close the grounding switches.

He must be sure that pantographs are held down by latches and grounding switches are properly closed.

Instruction pertaining to repair work on or near main power circuits on electric engines or multiple unit cars will then govern, except that each employe must apply his personal danger tags before starting to work.

Assigned employe must know that all personal danger tags are removed, that all persons are clear, and that all tools and working materials have been properly placed.

Then the assigned employe may open the grounding switches and raise the pantographs.

The assigned employe will be responsible for carrying out his instructions as outlined in the preceding paragraphs.

11. At engine terminals, except when otherwise specified, electric engines ready for service shall be left with pantographs down, grounding switches open, and wheels chocked.

12. Pantographs must not be raised until it is known that all persons in the vicinity of the electric engine or multiple unit car are clear of all circuits and understand that the equipment is to be energized.

Working Near Overhead Wires

1. Work must not be done on any circuit until the part to be worked upon is deenergized and properly grounded by, or under the supervision of, a Class A employe.

2. Persons other than qualified railroad employes must not be permitted to work near overhead wires or apparatus, except when protected by a Class A employe who will take necessary precautions for their safety before starting and during the progress of the work.

3. Emergency repair work of any nature to clear up defects and permit equipment to be moved to an established location for making repairs must not be done on the top or roof of any freight car, passenger car, cabin car, engine, or other high equipment or high lading while
under overhead contact wire, except by Class A, B, or C employes.

Working on Wire Train

1. The gang foreman of the wire train must know that all employes assigned to work on the wire train have received and thoroughly understand the following instructions. He will be responsible for the strict observance and enforcement of these instructions.

2. The gang foreman must obtain clearances necessary for the work to be performed or assign a Class A employe to obtain such clearances.

3. When a Class A employe is assigned to obtain clearances, the gang foreman must advise him the designations of the circuits to be deenergized, the extent of clearance, the locations, and the nature of the work to be performed.

4. After the required clearance has been received, the Class A employe must personally report to the gang foreman with form M.P. 260 showing the designations of circuits deenergized and the extent of clearance received.

5. When gang foreman leaves the immediate vicinity where work is being performed, he must assign a Class A employe to take charge until his return and must advise each man in the gang the name of the person assigned to take charge.

6. The gang foreman or assigned Class A employe in charge, after personally receiving clearance and filling out form M.P. 260, or upon being presented with form M.P. 260 by Class A employe who has obtained clearance, must:

(a) Explain to all men involved the designations of the circuits deenergized and the extent of the clearance obtained. Each man must repeat the information received.

(b) Personally direct the raising of the grounded pantograph and observe it strike the contact wire.

(c) Be the first person to ascend to the top of the equipment.

(d) Personally direct the application of the required grounding devices.

(e) Direct the attention of each man to the location of energized circuits in proximity to the work. Each man must repeat the information received.
(f) Insofar as practicable, so locate himself that he can observe the movements of all men on top of the equipment at all times. Where this is not practicable, he must assign a Class A employe to protect workmen not under his immediate supervision.

(g) Upon completion of the work, direct the removal of grounding devices and be the last man to descend from the top of the equipment.

(h) Immediately advise all men that the circuits are to be energized. Each man must repeat the information received.

7. All employes, regardless of their assignment or duty, must, upon boarding the wire train, report to the gang foreman or Class A employe in charge before going on top of the equipment.

8. When adjacent circuits are energized and it is necessary to work in proximity to the energized wires, this work must be personally supervised by the gang foreman or Class A employe in charge, who must take precautions necessary to prevent tools, apparatus, or Class A employes from approaching within fourteen (14) inches of wires energized at 11,000 volts.

9. Under no circumstances may other than Class A employes be permitted to approach within three (3) feet of wires energized at 11,000 volts.

**Employes Assigned to Protection Duties**

1. Class A employes assigned duties of protecting other persons must be thoroughly conversant with the following instructions, and with MW & S Safety Rules and must have copies of both those instructions in their possession while on duty.

2. The Class A employe will be responsible for the protection of each man in the gang to which he has been assigned.

3. At the beginning of each tour of duty, the Class A employe will instruct the foreman and each man in the gang that he is protecting, of the dangers surrounding them, calling their particular attention to any hazards to be encountered by the nature of the work to be done.

4. Before any work is started the Class A employe must indicate to the foreman and each man in the gang, the structure or portion of the structure on which work can be performed.
5. If in the opinion of the Class A employe, any man in the gang does not understand the instructions due to not having a proper knowledge of the English language, or for any other reason whatever, such man shall not be permitted to work.

6. The Class A employe must place himself in a position which will permit close observation of all locations within proximity to the energized wires and from which he can best observe the movement of all men toward such locations.

7. The Class A employe will, under no condition, assume that the men having been instructed by him will adhere strictly to such instructions, but will remain alert to detect any potential violations of those instructions.

8. The Class A employe must not engage in any work himself, nor shall he converse with the men or foreman, any more than is necessary to convey to them the instructions he has to give them.

9. When the Class A employe leaves his gang for any reason, he must notify the foreman and each man in the gang to stop all work in the vicinity of the wires, personally assuring himself that all men have moved to a safe distance before his departure. The Class A employe will obtain the signature of the foreman on form MW-8, that he and the men have been informed that the Class A employe is leaving the gang, and that they will not resume work until advised to do so on return of the Class A employe.

10. When there are two or more Class A employes engaged on the same operation, the Class A employe obtaining the clearance must have a thorough understanding with the other Class A employes as to clearances obtained and grounds to be applied.

11. When clearances have been obtained and the wires properly grounded, the Class A employe will indicate to the foreman and the men, the wires from which power has been removed, and the location of the grounding devices applied. The Class A employe must obtain on form MW-9 the signature of the foreman, indicating that he and the men have been so instructed, and will confine their work within the limits as outlined to them by the Class A employe.

12. When the clearances are to be released, the Class A employe will so inform the foreman and each man, and will personally observe that all men have moved to a safe distance from the wires to be energized, before re-
moving the grounding devices from the wires. He will obtain the signature of the foreman, on form MW-9, that he and the men have been advised that the wires will be energized, and that they shall remain at a safe distance from the wires until informed otherwise by the Class A employe.

13. When a Class A employe is assigned to protect more men than he feels he can look after with competence, he should promptly report the circumstances to his immediate superior.

14. The Class A employe will inform the foreman if any man on the work is unsafe and will not comply with instructions. If trouble is experienced with the foreman in maintaining safe working conditions, the Class A employe will immediately notify the power director.

**Keep Off Top of High Equipment**

1. Employes, except Class A, B or C employes in discharge of their duties, are prohibited to get upon, ride upon, or work upon top or roof of any freight car, passenger car, cabin car, engine, or other high equipment or high lading used in either freight or passenger service, while said freight car, passenger car, cabin car, or engine is under the energized catenary system.

2. Pilots must have each member of the crew promptly notified that

   (a) He is operating in electrified territory.

   (b) He must keep off top of equipment under overhead wires.

   (c) He must not bring tools, material, clothing or any part of his body in contact with third rail.

3. Tank cars or open cars on which lumber, poles, pipe, structural iron, trees, or other long material is to be loaded or unloaded, must, if possible, be placed on tracks where there are no overhead catenary wires or third rail, or on tracks where the overhead wires or third rail can be deenergized. Loading or unloading of flammable liquids from tank cars must be done on tracks equipped for this service and under special regulations therefor.

4. Station agents, yard masters, conductors, car inspectors, or their authorized representatives must forbid all persons to go on top of high lading or on roof of cars under the catenary system until the catenary system is deenergized and grounded. After the catenary system has
been deenergized and grounded over cars on which persons are to engage in loading and unloading material, all such persons must be warned to regard all the overhead wires as energized and that they must not allow their bodies or material of any kind to come within eight (8) feet of transmission wires, or within three (3) feet of catenary system and signal power wires, or in contact with third rail.

5. Certain locations, where minimum clearance of approximately 24 feet, 6 inches, is provided between contact wire and top of rail, are designated HIGH WIRE territory, limits of which are marked by HIGH WIRE and LOW WIRE signs.

![HIGH WIRE](image1)

![LOW WIRE](image2)

**Operation of Electric Equipment**

1. Overhead contact wires are divided into sections and the power supply is controlled through circuit breakers and sectionalizing switches. Overhead contact wires are normally energized at all times. When a section of the catenary system has been deenergized, electric equipment must not be run into or out of such section with pantographs up.

2. When electric equipment loses power and has stopped before power is restored, pantographs must be dropped and the Superintendent notified. Stops should be made when possible near a telephone.

3. When a defect develops in the main power circuits on electric equipment, pantographs must be dropped at once, if not automatically done. Pantographs must not be raised until it is safe to do so.

4. After a complete operation of the pantograph relay resulting in grounding the overhead contact wire and lowering the pantograph, the pantograph shall not be raised except by the use of the pantograph UP button and provided control air reservoir pressure is at least 60 lbs.; if the control air reservoir pressure is below 60 lbs., the manually operated grounding switches must be closed and not opened until either the pantographs are tied down or control air reservoir pressure has been restored.
5. When electric engines or multiple unit cars are derailed and contact is broken with rail return circuit, the engines or the multiple unit cars must be considered energized. Pantographs must be dropped immediately and grounding switches closed. All persons must maintain three (3) feet clearance between derailed equipment and ground, until pantographs have been dropped, or until contact wire or third rail is deenergized and grounded.

6. When two or more electric trains stop on the same track a short distance apart, the following train should not start until the preceding train shall have been moving thirty (30) seconds.

7. When electric engines help on rear, extreme care should be taken to avoid damage when starting. Current should not be used to keep engine against the train while standing.

8. Master controller handle of multiple unit cars and emergency train brake attachment to master controller of electric engines, in road service, must NOT be blocked, fastened, or otherwise tampered with, to prevent spring tension returning them to emergency position if engineer's hand and/or foot is removed.

9. When electric engines are set off enroute, the engine should be properly secured by applying the hand brake after the air brake has been released.

10. Motor stop sign indicates end of contact wire. Electric engines or multiple unit cars must not pass this sign with pantographs up.

**Normally Deenergized Tracks**

1. Overhead contact wires on certain industrial tracks are normally deenergized as indicated in the timetable.

2. It must be known that the sectionalizing switch controlling industrial track is closed before entering, and opened after leaving and that electric equipment is clear. If it becomes necessary to deenergize the overhead contact wire while electric equipment is on industrial track, pantographs should be dropped before sectionalizing switch is opened and kept down until wire has again been energized.

3. Before the sectionalizing switch controlling track normally deenergized is closed, the catenary system must be clear of obstructions and material, and all persons near the track must be warned.
4. On tracks where flammable liquids are handled, special switches are provided to simultaneously deenergize and ground the overhead contact wire.

**Deenergizing Catenary Wires**

1. When necessary to deenergize catenary wires over any track under the jurisdiction of a train dispatcher, train director, yard master, enginehouse foreman (their assistants, or other authorized employes, except at certain locations specified by the Superintendent), a plate order form CT-399 must be made effective by that employe, and in the manner indicated on the form, before catenary wires are deenergized.

2. When a plate order is made effective, plate lights where provided must be lighted to indicate tracks from which electric equipment must be held clear.

**Phase Break Signs and Indicators**

1. Phase break signs are located on first catenary pole in advance of a phase break.

2. Position light phase break indicators of type shown are located in advance of the phase break sign. When indicator is lighted, a section of the phase break is deenergized and all electric trains approaching a phase break on any track will be governed by the following:

One engine with one pantograph up:

Place controller in OFF position before entering the phase break, keeping it in that position until after the phase break is passed.

One engine with both pantographs up, two or more engines, and multiple unit trains:

Drop pantographs before entering the phase break, keeping them down until after phase break is passed.

3. Phase breaks are located as specified in the timetable.
Dead Sections

1. Dead sections are installed in overhead wires at certain locations specified in the timetable. The limits of these sections are designated by dead section signs—

2. All electric trains approaching a dead section will be governed by the following:

One engine with one pantograph up, two or more engines coupled with not more than one pantograph up on any engine, and multiple unit trains:

Place controller in OFF position before entering the dead section, keeping it in that position until after the dead section is passed.

One engine with both pantographs up, two or more engines coupled with two pantographs up on any engine:

Drop pantographs before entering the dead section, keeping them down until after the dead section is passed.

Sleet Instructions

1. Engineman must be on the alert for excessive arcing caused by sleet formation, and when such is observed he must at once comply with instructions governing double pantograph order operation. The first indication of sleet shall be reported promptly to the Superintendent who will issue a double pantograph order when conditions warrant.

2. With double pantograph order in effect, electric engines operating singly shall run with both pantographs up, except through phase breaks and dead sections.

Electric engines coupled shall run with both pantographs up on leading engine and rear pantograph up on each trailing engine, except through phase breaks and dead sections.

3. With double pantograph order in effect, pantograph extra pressure device on MP 54 cars and type B-1 engines shall be used as follows:

(a) As soon as sufficient sleet forms on the pantograph to cause it to leave the contact wire, the pantograph UNLOCK button should be pushed in and locked with the pin provided for that purpose.

(b) As soon as sleet stops forming and pantograph is free of ice, the UNLOCK button should be re-
leased to eliminate excessive pressure on the contact wire.

(c) The locking pin should be removed when it is desired to lower and latch down the pantograph.

4. Patrol trains, consisting of five or more multiple unit cars or two electric engines coupled, will be assigned to remove sleet from contact wires. In case of heavy sleet, it may be necessary to open the control switches on the leading car or open motor cut-out switches on the leading engine, in order to reduce excessive arcing. Class A employee, instructed in renewal of pantograph shoes, will be assigned to accompany each patrol train. Patrol train will be equipped with one ground stick and five pantograph shoes.

5. Two electric engines light, operating as a patrol train to remove sleet from contact wires, shall run with two pantographs up on leading engine, and with rear pantograph up on trailing engine except through phase breaks and dead sections. Any three pantographs may be up in an emergency but rear pantograph of the leading engine and the front pantograph of the trailing engine shall not be up at the same time when it can be avoided.

6. When contact wire is heavily coated with sleet, speed should be reduced below thirty (30) miles per hour in order to effect better removal of sleet from the contact wire with minimum wear on pantograph shoes.

7. When practicable electric engines and multiple unit cars in yards, storage tracks, or standing at any point, should have pantographs lowered and raised frequently to prevent accumulation of sleet. In case pantographs operate sluggishly, pantograph pole should be used to raise and lower pantographs to remove sleet, avoiding contact of the shoe with the energized overhead wire.

8. During sleet storms, pantograph shoes of all electric engines in passenger and freight service will be inspected at locations specified in the timetable.

9. When a pantograph lowers due to sleet or when sleet load on a pantograph becomes excessive resulting in heavy arcing between shoe and wire, master controller must be shut off, and an attempt made to raise and lower the pantograph several times. If this fails the train must be stopped, under a contact wire which is five (5) or more feet above the roof of engine or multiple unit car if possible. Then an attempt should be made to raise and lower the pantograph several times with the pantograph pole, avoiding contact of the shoe with the overhead wire.
If formation of sleet is such that the pantograph can be made to operate only by removing the sleet, the procedure outlined below must be followed:

(a) When the energized contact wire is less than five (5) feet above the roof of the engine or multiple unit car, the Superintendent must be advised and arrangements made for the necessary protection.

(b) When the energized contact wire is five (5) feet or more above the roof of engine or multiple unit car:

Before going on roof or touching any part of pantograph assembly—

- Full control air pressure must be obtained.
- Battery switches must be closed.
- Pantograph DOWN button or switch must be in the IN or DOWN position.
- All pantographs must be down.
- Ice must be removed from step treads leading to roof to insure safe footing.
- All grounding switches must be closed and locking pins inserted.
- The position of all overhead wires must be noted.
- Pantographs must be held down by latches, and grounding switches must be making proper contact.
- Standard warning tag MP 397, properly filled out, or approved personal danger tag must be applied to grounding switch handles.

While working on the roof—

- Extra precautions against slipping must be taken.
- Keep at least three (3) feet from all wires.
- Stand astride pantograph tubing so it cannot raise, but do not bear excessive weight on tubing which might throw it out of position.
- Do not work directly under the wires.
- Lightly tap tubing, springs, rods, shoes, and other parts to remove sleet.

Before descending, be sure that all pantographs are held down by latches, and grounding switches are closed.
After all persons have descended—

Standard warning or personal danger tags must be removed from grounding switch handles by persons who applied them.

Keep as far as possible from all normally energized parts.

Open grounding switches.

Prepare engine or car for service.

10. At terminals, sufficient men will be provided to remove sleet from pantograph assemblies.

When this type of work must be done under energized wire and is of sufficient magnitude to require a number of groups working on different engines or multiple unit cars, the supervisory employe shall designate one man in charge of each group to be responsible and know that each member of the group follows the procedure outlined in the preceding instruction.

11. When request is made to stop engine for pantograph inspection by qualified employe, the pantograph shall be lowered and left down until the inspection is completed.

**Third Rail**

1. The third rail is divided into sections and the power supply is controlled by circuit breakers and sectionalizing switches. Third rail is normally energized (live). Sectionalizing switches are located in boxes alongside the third rail.

2. Sectionalizing third rail switches for industrial tracks are in boxes located close to the track switch. Special switches are used on industrial tracks where flammable liquids are handled and on certain other tracks. Third rail on industrial tracks is normally deenergized. It must be known that the third rail sectionalizing switch controlling industrial track is closed before entering, and opened after leaving, and that electric equipment is clear. Employe operating sectionalizing switch must turn his face away to guard against injury in case of a flash.

3. Before the sectionalizing switch controlling tracks normally deenergized is closed, the third rail must be clear of obstructions and material and all persons near the track must be warned. When electric equipment has completed shifting and is clear, the sectionalizing switch must be opened and the switchbox closed and locked.
4. If a flash is observed on or near the third rail when sectionalizing switch controlling tracks normally deenergized is closed, the switch must be opened at once and third rail inspected. Any foreign object found in contact with the third rail must be removed, then sectionalizing switch may again be closed. If a second flash occurs, the sectionalizing switch must be opened and the circumstances reported to the Superintendent.

5. When necessary to deenergize the third rail in an emergency to prevent personal injury or damage to property, the nearest substation or the power director must be notified immediately and the circumstances reported to the Superintendent.

6. Emergency jumpers are kept at places designated in the timetable to supply power to electric equipment for short movements where contact with the third rail is lost. Employe using the jumpers must guard against injury or burning by arc when contact is made or broken. Prompt report must be made to the Superintendent when:
   (a) Emergency jumpers are not at designated places.
   (b) Difficulty is experienced in use of the jumpers.
   (c) The jumpers are defective.
   (d) The jumpers are removed from and not returned to designated place.

7. Connecting or disconnecting bus jumpers without first opening the compressor, motor-generator, lighting and heating switches on deenergized units is prohibited, unless all units in the train or draft are in contact with or all units are entirely disconnected from the third rail.

8. When a section of third rail has been deenergized, the power director must confer with the Superintendent, enginehouse foreman, or yardmaster so that proper orders or instructions may be issued. No multiple unit train or electric engine must be permitted to run into or out of such dead section, except when bus jumpers on the cars have been disconnected and a single car or electric engine will not bridge gaps between energized and deenergized third rail sections.

**Operation of Maintenance of Way Machinery**

1. When rail-operated maintenance of way machinery equipped with boom is used in electrified territory, it is the responsibility of the operator to know that the boom is properly grounded in accordance with drawing
D-448643, latest issue. Such machinery must be operated so that the following clearance restrictions are observed:

(a) With wires energized (live):

Without supervision of Class A or C employe:

Not closer than eight (8) feet to transmission wires.

Not closer than three (3) feet to catenary system.

Not closer than three (3) feet to signal power wires.

Under supervision of Class A or C employe:

Not closer than eight (8) feet to transmission wires.

Not closer than fourteen (14) inches to catenary system.

Not closer than fourteen (14) inches to signal power wires.

(b) With wires deenergized (apparently dead) and not grounded:

Without supervision of Class A or C employe:

Not closer than eight (8) feet to transmission wires.

Not closer than three (3) feet to catenary system.

Not closer than three (3) feet to signal power wires.

Under supervision of Class A or C employe:

Avoid contact with wires.

(c) With wires deenergized and grounded:

Without supervision of Class A or C employe:

Avoid contact with the wires.

Under supervision of Class C employe:

Light contact with the wires is permitted.

Under supervision of Class A employe:

Full contact with the wires is permitted, avoiding damage.

2. If in the opinion of the foreman or the operator any hazard is involved, he must request the protection of a Class A employe.
Operation of Maintenance and Construction
Roadway Machinery

1. When off-track or on-track mobile and crawler boom cranes and similar roadway machines are used in proximity to overhead electrification wires, power wires, and electrification apparatus, it is the responsibility of the operator to know that the boom and supporting frames of such machines "are" properly grounded in accordance with drawing D-448643, latest issue. Equipment that is property of others is subject to these same regulations.

2. Unless properly grounded by and supervised by a Class A employe, such machinery must not be operated closer than eight (8) feet to overhead electrification wires, power wires, or electrical apparatus.

3. Location and working hours of all such machinery in proximity to overhead electrification wires, power wires, and electrical apparatus must be reported to the Superintendent who will notify the power director.

4. If in the opinion of the foreman or the operator any hazard is involved, he must request the protection of a Class A employe.

Operation of Wreck Derricks

1. When a wreck derrick is necessary at a wreck or derailment, the Superintendent will advise the power director who will promptly dispatch a Class A employe to the wreck. The Class A employe shall report at once to the trainmaster and to the wreck foreman. Should the wreck be of a serious nature, either a wire train or wire truck shall also be dispatched, so that major electrical work made necessary by the wreck will be properly performed.

2. When wreck derrick is operating under overhead wires where it is not necessary for boom to come within eight (8) feet of transmission wires or three (3) feet of the catenary system or signal power wires, such operation may be performed under the supervision of a wreck foreman, who is qualified to handle the boom under such conditions, without requiring the service of a Class A employe and without deenergizing the overhead wires.

3. Where it is necessary for the wreck derrick boom to come within eight (8) feet of transmission wires or three (3) feet of the catenary system or signal power wires, the wires must be deenergized and properly grounded by a Class A employe.
4. If it becomes necessary for the wreck derrick boom to come in contact with deenergized and grounded wires resulting in either upward or lateral pressure on wire, such operation shall be under the direction of a Class A employee. Wreck derrick not equipped with a cowl (wire guard) on tip of boom must not be allowed to come in contact with deenergized overhead wires.

5. Should it become necessary when operating a wreck derrick to have the overhead wire drawn out of alignment or removed, the wire shall be deenergized and properly grounded, and the work done by or under the direct supervision of a Class A employe.

6. Employes engaged in wrecking operations must be protected from energized (live) third rail. Rubber mats or blankets used for such protection must be in a safe condition.

7. In the use of outriggers, unnecessary damage to third rail protection boards must be avoided.

**Operation of Remote Control Boards**

1. In certain block or interlocking stations, or other normally attended locations, remote control boards have been installed for the operation and supervision of electric traction apparatus. Control switches with red and green indicating lamps and other devices are mounted on these boards.

2. Under no circumstances shall any control switch or other device be operated or tampered with except in accordance with the following instructions.

3. On a control switch, a red light denotes closed position and a green light denotes open position of its associated electric traction apparatus. When handle of the control switch is in locked-out position, there is no light indication. On a control switch equipped with a mechanical target indicator, the color showing on the target indicates position to which the control switch was last operated and does not necessarily denote position of the apparatus controlled.

4. In accordance with instructions from the power director, control switches and other devices may be operated by employees who have been properly instructed on the operation of remote control board at such location.

5. At the beginning of a tour of duty, the employe shall:

   (a) Visually check indications on the control boards.
(b) Depress ground lamp button (where control boards are so equipped) and note any difference in brilliancy of ground lamps.

(c) Note readings on direct current voltmeter and other indicating meters.

Any abnormal condition noted at this time or which may occur during the tour of duty must be reported immediately to the power director.

6. When operating control switches in accordance with instructions from the power director, the employee must repeat instructions as given, then perform operations in the order given by the power director.

7. When a control handle is operated to close apparatus, handle must be held in closed position approximately three (3) seconds. If red light indication is obtained, apparatus has been closed and completion of instruction shall be reported to power director. If red light indication is not obtained, control handle must be restored to neutral position and condition reported immediately to power director.

8. When control handle is operated to open apparatus, handle must be held in open position approximately three (3) seconds. Unless otherwise instructed by power director, handle must be restored to neutral position to observe green light indication. In the operation of signal power line circuit breakers, power director may instruct the employee simply to lock out the control handle to avoid automatic reclosing of circuit breaker which might occur if handle were restored to neutral position. Completion of the operation must be reported immediately to the power director.

9. When apparatus opens automatically, as indicated by alarm bell ringing and light indication changing from red to green, employee shall immediately notify the power director of all apparatus opening and follow his instructions.

10. Power director shall be notified immediately when transformer temperature alarm sounds.

11. When instructed to do so, employee shall operate control switch, lock out the handle, and apply blocking device with red tag, on which has been written the following:

(a) Name or number of apparatus.

(b) Number of clearance on which work is to be done.

(c) Name of person in charge of work.
(d) Signature of employee placing tag.
(e) Time and date tag is placed.
(f) Location.

Employee shall then report the operations to the power director who will repeat or correct the operations reported.

12. Tags and blocking devices must not be removed except as instructed by the power director. Upon receipt of such instructions, employee shall remove tags and write thereon the following:

(a) Time and date tag is removed.
(b) Name of employee who removed tag.

Operation and time shall be reported promptly to the power director.

13. All red warning tags which have been used as outlined in the foregoing shall be forwarded daily to the Supervisor of Communication and Signals.

**ELECTRIC ENGINES**

**Notching Restrictions and Tonnage Ratings—Passenger**

1. Notching restrictions and tonnage ratings for single electric engines operating in passenger service will be as follows, unless otherwise specified.

**Type GG1**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>Tons</td>
<td>Tons</td>
</tr>
<tr>
<td>None</td>
<td>1445 or Less</td>
<td>1330 or Less</td>
</tr>
<tr>
<td>18th Notch</td>
<td>1446 to 1750</td>
<td>1331 to 1600</td>
</tr>
<tr>
<td>16th Notch</td>
<td>1751 to 2500</td>
<td>1601 to 2000</td>
</tr>
</tbody>
</table>

When the tonnage or the number of cars of a train exceeds values specified above, the train should be double-headed. The computed tonnage and number of cars of a doubleheaded train should be considered equally divided between the engines. Notching restrictions should be observed when tonnage or number of cars thus computed for a single engine exceeds the minimum values specified above.
2. Electric engines, in passenger service with one motor circuit cut out, are limited to 60 percent of the above tonnage ratings.

Type GG1 engines, with two motor circuits cut out, should not be used in passenger service when it can be avoided, and then only in multiple operation. Tonnage rating is then limited to 20 percent of the value specified for a type GG1 engine with all motor circuits in service.

3. Type L6 and L6a engines in passenger service are limited to 80 percent of GG1 engine tonnage rating.

4. The weight of a train must be known before leaving a terminal and at intermediate points where consist of train is changed. A report shall be made to the Superintendent before moving a train which exceeds the engine tonnage rating.

The engineman shall be advised the weight of train.

5. A train heavier than 2000 tons should not be handled through North or East River Tunnels (New York Division) without doubleheading.

6. A train heavier than 1750 tons should not be handled southward through the B&P Tunnel at Baltimore (Chesapeake Division) without doubleheading.

**Tonnage Computation**

1. In computing tonnage for operation of electric engines in passenger service, use weights as shown in following table:

<table>
<thead>
<tr>
<th>Type of Car</th>
<th>Tons Empty</th>
<th>Mail Service</th>
<th>Baggage and Express Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baggage (B60 &amp; Foreign)</td>
<td>55</td>
<td>75</td>
<td>65</td>
</tr>
<tr>
<td>Refrigerator (R50B &amp; Foreign)</td>
<td>60</td>
<td>85</td>
<td>75</td>
</tr>
<tr>
<td>Baggage, Mail (BM70 &amp; M70)</td>
<td>70</td>
<td>80</td>
<td>65</td>
</tr>
<tr>
<td>Express (X29)</td>
<td>25</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>*Lightweight Coach—</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Congo type&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Tubular type&quot;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Other L. W.</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Standardweight Coach</td>
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<td></td>
</tr>
<tr>
<td>*L. W. Cafe, Cafe Lge., etc.</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*S. W. Cafe, Cafe Lge., etc.</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. W. Diner—Single</td>
<td>75</td>
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<td></td>
</tr>
<tr>
<td>S. W. Diner—Single</td>
<td>90</td>
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<td></td>
</tr>
<tr>
<td>L. W. Diner—Twin</td>
<td>155</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. W. Diner—Twin</td>
<td>190</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. W. Pullman Sleepers—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-War</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-War</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. W. Pullman Sleepers</td>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*L. W. Parlor Cars</td>
<td>62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*S. W. Parlor Cars</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. W. Parlor Lounge Cars</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. W. Parlor Lounge Cars</td>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Cars</td>
<td>95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Add 5 tons when loaded.
Notching Restrictions and Tonnage Ratings—Freight

1. Notching restrictions for electric engines operating in freight service will be as follows, unless otherwise specified.

   GG1 (90 MPH) .......... 17th Notch

2. The following tonnage ratings require momentum operation on ruling grades and certain intermediate grades. In case train is stopped on such grades, assistance should be procured before starting.

   All speed restrictions shall be observed, starting and acceleration closely watched. Weak field operation for periods longer than five minutes must be avoided.

3. Electric engines, with one motor circuit cut out, are limited to 60% of the tonnage ratings.

4. Electric engines assigned to passenger service for which no freight tonnage rating is specified shall not be used in freight service.

Weight of Electric Engines Hauled Dead in Trains

<table>
<thead>
<tr>
<th>Type of Engine</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>E44</td>
<td>192</td>
</tr>
<tr>
<td>E44a</td>
<td>188</td>
</tr>
<tr>
<td>GG1</td>
<td>239</td>
</tr>
<tr>
<td>L6, L6a</td>
<td>153</td>
</tr>
</tbody>
</table>

Authorized Current Ratings

<table>
<thead>
<tr>
<th>Type</th>
<th>Overload Relay Setting</th>
<th>Maximum Accelerating Current</th>
<th>Notch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amperes</td>
<td>Amperes</td>
<td></td>
</tr>
<tr>
<td>GG1 (90 mph)</td>
<td>2750</td>
<td>Below 2750*</td>
<td>Starting</td>
</tr>
<tr>
<td>(4800-4875)</td>
<td></td>
<td>2300</td>
<td>1-17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>18-22</td>
</tr>
<tr>
<td>GG1 (100 mph)</td>
<td>3000</td>
<td>Below 3000*</td>
<td>Starting</td>
</tr>
<tr>
<td>(4876-4938)</td>
<td></td>
<td>2500</td>
<td>1-17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2200</td>
<td>18-22</td>
</tr>
</tbody>
</table>

* If necessary to use higher starting current make detailed report at end of trip.

Note—Type E44 and E44a engines provided with notching guides and traction motor load indicators in lieu of authorized current ratings.
### Authorized Maximum Tonnage Ratings - Electric Freight Locomotives

<table>
<thead>
<tr>
<th>Route/Location</th>
<th>One Unit</th>
<th>Two Units</th>
<th>Three Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bay View to Edge Moor</td>
<td>E-44 E-44A GG-1 90 mph</td>
<td>E-44 E-44A GG-1 90 mph</td>
<td>E-44 E-44A GG-1 90 mph</td>
</tr>
<tr>
<td>Bay View to Enola (via Perryville and freight tracks at Lemo)</td>
<td>Note</td>
<td>6000 4400</td>
<td>10000 12000</td>
</tr>
<tr>
<td>Bay View to Potomac Yard, no helper</td>
<td>Helper B&amp;P Jct. to Fulton: GG-1</td>
<td>5400 4000</td>
<td>11000 13500</td>
</tr>
<tr>
<td>Edge Moor to Bay View</td>
<td>Note</td>
<td>5500 4000</td>
<td>11000 12000</td>
</tr>
<tr>
<td>Edge Moor to Enola (via Perryville and freight tracks at Lemo)</td>
<td>Note</td>
<td>5400 4000</td>
<td>11000 12000</td>
</tr>
<tr>
<td>Edge Moor to Grays Ferry, if stopped at Baldwin</td>
<td>Momentum operation at Baldwin or with helper if stopped</td>
<td>3900 4000</td>
<td>8700 10000</td>
</tr>
<tr>
<td>Enola to Bay View, if stopped at Perryville</td>
<td>Momentum operation at Perryville or with helper if stopped</td>
<td>4200 4000</td>
<td>9200 10000</td>
</tr>
<tr>
<td>Enola to Edge Moor, if stopped at Perryville</td>
<td>Momentum operation at Perryville or with helper if stopped</td>
<td>5200 4000</td>
<td>9700 10000</td>
</tr>
<tr>
<td>Enola to Jersey City or Brown (via Low Grade)</td>
<td></td>
<td>5300 4000</td>
<td>10500 12000</td>
</tr>
<tr>
<td>Brown to South Amboy</td>
<td>Helper: 1 (BS-10)</td>
<td>3150 2700</td>
<td>7100 8000</td>
</tr>
<tr>
<td>Helper: 2 (BS-10)</td>
<td></td>
<td>4250 3700</td>
<td>8850 9700</td>
</tr>
</tbody>
</table>

Note: see Reference on Page 42.
<table>
<thead>
<tr>
<th>ONE UNIT</th>
<th>TWO UNITS</th>
<th>THREE UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-44</td>
<td>E-44A</td>
<td>E-44</td>
</tr>
<tr>
<td>GG-1</td>
<td>GG-1</td>
<td>E-44</td>
</tr>
<tr>
<td>90 mph</td>
<td>90 mph</td>
<td>90 mph</td>
</tr>
<tr>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td><strong>Note</strong></td>
<td><strong>Note</strong></td>
</tr>
<tr>
<td>Enola to Philadelphia (via Low Grade)</td>
<td>Enola to Philadelphia (via Low Grade)</td>
<td>Enola to Philadelphia (via Low Grade)</td>
</tr>
<tr>
<td>Helper Thorndale to Paoli</td>
<td>Helper Thorndale to Paoli</td>
<td>Helper Thorndale to Paoli</td>
</tr>
<tr>
<td>Frankford Jct. to Pavonia</td>
<td>Frankford Jct. to Pavonia</td>
<td>Frankford Jct. to Pavonia</td>
</tr>
<tr>
<td>Grays Ferry to Edge Moor</td>
<td>Grays Ferry to Edge Moor</td>
<td>Grays Ferry to Edge Moor</td>
</tr>
<tr>
<td>if Stopped at Grays Ferry</td>
<td>if Stopped at Grays Ferry</td>
<td>if Stopped at Grays Ferry</td>
</tr>
<tr>
<td>Momentum operation at Grays Ferry or with helper if stopped</td>
<td>Momentum operation at Grays Ferry or with helper if stopped</td>
<td>Momentum operation at Grays Ferry or with helper if stopped</td>
</tr>
<tr>
<td>Harrisburg to Philadelphia (via Main Line)</td>
<td>Harrisburg to Philadelphia (via Main Line)</td>
<td>Harrisburg to Philadelphia (via Main Line)</td>
</tr>
<tr>
<td>Jersey City Terminals or Brown to Enola (via Low Grade)</td>
<td>Jersey City Terminals or Brown to Enola (via Low Grade)</td>
<td>Jersey City Terminals or Brown to Enola (via Low Grade)</td>
</tr>
<tr>
<td>South Abbey to Brown with 1 helper</td>
<td>South Abbey to Brown with 1 helper</td>
<td>South Abbey to Brown with 1 helper</td>
</tr>
<tr>
<td>with 2 helpers</td>
<td>with 2 helpers</td>
<td>with 2 helpers</td>
</tr>
<tr>
<td><strong>90 mph</strong></td>
<td><strong>90 mph</strong></td>
<td><strong>90 mph</strong></td>
</tr>
<tr>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td><strong>Max Tonnage Ratings</strong></td>
<td><strong>Max Tonnage Ratings</strong></td>
<td><strong>Max Tonnage Ratings</strong></td>
</tr>
<tr>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td><strong>Enola to Philadelphia (via Low Grade)</strong></td>
<td><strong>Enola to Philadelphia (via Low Grade)</strong></td>
<td><strong>Enola to Philadelphia (via Low Grade)</strong></td>
</tr>
<tr>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td><strong>Helper Thorndale to Paoli</strong></td>
<td><strong>Helper Thorndale to Paoli</strong></td>
<td><strong>Helper Thorndale to Paoli</strong></td>
</tr>
<tr>
<td><strong>Frankford Jct. to Pavonia</strong></td>
<td><strong>Frankford Jct. to Pavonia</strong></td>
<td><strong>Frankford Jct. to Pavonia</strong></td>
</tr>
<tr>
<td><strong>Grays Ferry to Edge Moor</strong></td>
<td><strong>Grays Ferry to Edge Moor</strong></td>
<td><strong>Grays Ferry to Edge Moor</strong></td>
</tr>
<tr>
<td><strong>if Stopped at Grays Ferry</strong></td>
<td><strong>if Stopped at Grays Ferry</strong></td>
<td><strong>if Stopped at Grays Ferry</strong></td>
</tr>
<tr>
<td><strong>Momentum operation at Grays Ferry or with helper if stopped</strong></td>
<td><strong>Momentum operation at Grays Ferry or with helper if stopped</strong></td>
<td><strong>Momentum operation at Grays Ferry or with helper if stopped</strong></td>
</tr>
<tr>
<td><strong>Harrisburg to Philadelphia (via Main Line)</strong></td>
<td><strong>Harrisburg to Philadelphia (via Main Line)</strong></td>
<td><strong>Harrisburg to Philadelphia (via Main Line)</strong></td>
</tr>
<tr>
<td><strong>Jersey City Terminals or Brown to Enola (via Low Grade)</strong></td>
<td><strong>Jersey City Terminals or Brown to Enola (via Low Grade)</strong></td>
<td><strong>Jersey City Terminals or Brown to Enola (via Low Grade)</strong></td>
</tr>
<tr>
<td><strong>Helper Morrisville Yard: 2 (AS-10)</strong></td>
<td><strong>Helper Morrisville Yard: 2 (AS-10)</strong></td>
<td><strong>Helper Morrisville Yard: 2 (AS-10)</strong></td>
</tr>
<tr>
<td><strong>South Abbey to Brown with 1 helper</strong></td>
<td><strong>South Abbey to Brown with 1 helper</strong></td>
<td><strong>South Abbey to Brown with 1 helper</strong></td>
</tr>
<tr>
<td><strong>with 2 helpers</strong></td>
<td><strong>with 2 helpers</strong></td>
<td><strong>with 2 helpers</strong></td>
</tr>
<tr>
<td>Pavonia to Frankford Jct.</td>
<td>1900</td>
<td>1650</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Philadelphia (52nd St. Yard) to Enola or Harrisburg (Via A&amp;S Br., Columbia Br., or Main Line)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Helper to Bryn Mawr or Paoli:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (EFS-17)</td>
<td>3600</td>
<td>2900</td>
</tr>
<tr>
<td>1 (E-44)</td>
<td>3600</td>
<td>2900</td>
</tr>
<tr>
<td>2 (EFS-17)</td>
<td>3600</td>
<td>2900</td>
</tr>
<tr>
<td>2 (E-44)</td>
<td>3600</td>
<td>2900</td>
</tr>
<tr>
<td>3 (EFS-17)</td>
<td>3600</td>
<td>2900</td>
</tr>
<tr>
<td>1 (EFS-17)</td>
<td>M</td>
<td>4000</td>
</tr>
<tr>
<td>1 (E-44)</td>
<td>M</td>
<td>4000</td>
</tr>
<tr>
<td>2 (EFS-17)</td>
<td>M</td>
<td>4000</td>
</tr>
<tr>
<td>2 (E-44)</td>
<td>M</td>
<td>4000</td>
</tr>
<tr>
<td>3 (EFS-17)</td>
<td>M</td>
<td>4000</td>
</tr>
<tr>
<td>Note: see Reference on Page 42.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Philadelphia (Stadium) to Enola or Harrisburg (Via A&S Br., Columbia Br., or Main Line, not stopped on adverse grade) | | | | | | |
| | M | | | | | |
| Helper, 34th Street to Bryn Mawr or Paoli: | | | | | | |
| 1 (EFS-17) | 3600 | 2900 | 7300 | 5800 | 8000 | 6800 |
| 1 (E-44) | 3600 | 2900 | 7300 | 5800 | 8000 | 6800 |
| 2 (EFS-17) | 3600 | 2900 | 7300 | 5800 | 8000 | 6800 |
| 2 (E-44) or 3 (EFS-17) | 3600 | 2900 | 7300 | 5800 | 8000 | 6800 |
| 1 (EFS-17) | M | 4000 | 3200 | 6200 | 5550 | 8300 |
| 1 (E-44) | M | 4000 | 3200 | 6200 | 5550 | 8300 |
| 2 (EFS-17) | M | 4000 | 3200 | 6200 | 5550 | 8300 |
| 2 (E-44) or 3 (EFS-17) | M | 4000 | 3200 | 6200 | 5550 | 8300 |

Note: see Reference on Page 42.
<table>
<thead>
<tr>
<th>AUTHORIZED MAXIMUM TONNAGE RATINGS - ELECTRIC FREIGHT LOCOMOTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ONE UNIT</strong></td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>E-44</td>
</tr>
<tr>
<td>90 mph</td>
</tr>
<tr>
<td><strong>Note</strong></td>
</tr>
<tr>
<td>E-44</td>
</tr>
</tbody>
</table>

**Polomac Yard to Bay View**

- 3200
- 3500
- 3300

**South Philadelphia to Enola (via Perryville and freight tracks at Lemo)**

- M 3400
- M 3100
- M 3000

**South Philadelphia to St. Yard (52nd St. U.G. Br.)**

- M 4400
- M 4000
- M 3500

**Morrisville Yard to Enola, Harrisburg**

- 3200
- 3500
- 3300

**Helper Morrisville Yard: 2 (AS-10)**

- 2900
- 2900
- 2900

**Helper Morrisville Yard: 2 (AS-10)**

- 3300
- 3300
- 3300

**Helper Morrisville Yard: 2 (AS-10)**

- 4000
- 4000
- 4000

**Note**

- E-44A or equivalent unless otherwise specified.
- For E-44A with one traction motor circuit cut out, use one-half (1/2) rating.
- Note M - Ratings thus marked may be used only for trains of mineral freight with average gross weight per car exceeding 60 tons.
- Note E - Empties.

**Morrisville Yard to Enola: 2 (AS-10)**

- 2800
- 2800
- 2800

**Helper Morrisville Yard: 2 (AS-10)**

- 3300
- 3300
- 3300

**Helper Morrisville Yard: 2 (AS-10)**

- 4000
- 4000
- 4000

**Note**

- All speed restrictions shall be observed, starting and acceleration assistance may be required to start train, and weak field operation for long periods avoided as much as possible.
- These ratings require minimum operating speed on all grades to keep engine running, and require maximum braking on all grades.
- E-44A or equivalent unless otherwise specified.
Snow Screens

1. If snow screens are not applied to electric engines before leaving terminal and a snow storm is encountered enroute, snow screens, where provided, must be applied and properly secured.

2. Engines hauling trains may have the snow screens applied while the engines are drifting.

Steam Heating Boilers

1. The boiler shall NOT be operated in high flame when electric engine is standing under LOW WIRES.

2. When possible, engines must not be stopped with stack under porcelain or wood stick insulators or under bridges.

MULTIPLE UNIT CARS

General

1. When practicable, trains arriving at yard or terminal should have pantographs lowered promptly, unless other instructions prevent.

2. Multiple unit trains shall not assist in starting other trains.

3. Before leaving the operating compartment a full service application of the brakes must be made, and suitable steps taken to prevent unauthorized operation of equipment.

4. At the end of run or when changing operating location a full service application of the brakes shall be made, and cut-out cock in brake pipe closed before removing the brake valve handle. The controller and brake valve handles should then be removed and the end door swung into position and latched against the master control apparatus. The window in the side door should be closed.

5. When making movements of cars with two engineers, one operating from each end, the air brake shall be applied and the cut-out cock closed on the end which has been the operating end before engineman on opposite end takes charge. This is necessary in order to have full control of the air brakes at the end from which the train is operated.

6. A passenger train hauling a dead multiple unit car must not exceed the maximum speed authorized for such car in timetable Special Instruction 1157-G1, unless otherwise instructed by Superintendent.
A freight train hauling a dead multiple unit car must not exceed a speed of 50 miles per hour.

The Superintendent will authorize speed in writing for cars that must be hauled at a slower speed.

When moved dead in freight train, multiple unit cars should be placed in rear of train, preferably just ahead of last car.

7. Trains operated from any position other than front end of train must not exceed a speed of thirty (30) miles per hour.

8. No train of MP-54 cars shall exceed 14 units, and no train of MP-85 cars shall exceed 15 units. Dead cars in train are not excepted.

**Multiple Unit Cars—MP-54**

1. Heater switches should be opened at least fifteen minutes before arrival at terminal, when this can be done without discomfort to the passengers.

2. When outside temperature is 40 degrees or below, or it is snowing, rear vestibule and two side doors should be closed on rear car of train and cab heater turned on to prevent brake valve becoming too stiff to operate.

3. When traction motors on a car become inoperative enroute, the control cut-out switch should be opened.

4. Heat numeral signs 0-1-2-3 will be displayed at locations specified in the timetable. Unless otherwise instructed by the Superintendent, power directors will obtain outdoor temperature readings at frequent intervals and will direct display of heat numeral signs in accordance with the following:

   Temperature above 55 degrees ............. 0
   Temperature between 30 and 55 degrees .... 1
   Temperature between 20 and 30 degrees .... 2
   Temperature below 20 degrees ............. 3

5. Car heater switches shall be operated to conform with heat numeral signs at all times, except to decrease car temperature when required and except as otherwise specified in the timetable.
6. Cold cars at terminals should be heated prior to departure. No. 3 heat applied to a cold car will raise car temperature to 65 degrees in approximately the following time:

<table>
<thead>
<tr>
<th>Outside Temperature</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 degrees</td>
<td>2 hours, 10 minutes</td>
</tr>
<tr>
<td>15 degrees</td>
<td>1 hour, 50 minutes</td>
</tr>
<tr>
<td>25 degrees</td>
<td>1 hour, 25 minutes</td>
</tr>
<tr>
<td>35 degrees</td>
<td>50 minutes</td>
</tr>
<tr>
<td>45 degrees</td>
<td>25 minutes</td>
</tr>
<tr>
<td>55 degrees</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

7. Cars equipped with pantographs, having maximum operating height of less than 24 feet, 6 inches, shall not be operated in high wire territory with pantographs up.

8. When power is shut off motors on a train moving at speed in excess of thirty (30) miles per hour, power must not be re-applied until speed has been reduced to less than thirty (30) miles per hour, if any class MP54E1 or MP54E2 cars are in the consist. This is necessary to prevent motors from flashing over.

9. Cars with motors inoperative may be placed in trains at terminals, only when necessary to move inoperative cars to shops for repairs and in extreme cases of deranged car supply to avoid serious delays, as follows:

<table>
<thead>
<tr>
<th>Total Number of Cars in Train</th>
<th>Between New Brunswick-Trenton-Phila.-South Amboy</th>
<th>Between North Phila.-Chestnut Hill</th>
<th>Between Phila.-Manayunk</th>
<th>Between Other Points</th>
<th>Number of Inoperative Cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
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</tr>
<tr>
<td>11</td>
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<td>3</td>
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</tr>
<tr>
<td>12</td>
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</tr>
<tr>
<td>13</td>
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<td>3</td>
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</tr>
<tr>
<td>14</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

NOTE: When motors of a double unit car are inoperative, such car and its trailer shall be counted as two cars.

**Multiple Unit Cars—MP-85**

1. Cooling and heating, including standby heating, are controlled automatically. Air conditioning and heating breakers should remain in closed position and selector switch, where provided, set for appropriate effect.

2. When terminal precooling of cars is required the special half plug should be used in the control plug receptacle.

3. If traction motors become inoperative enroute they should be cut out through use of the motor cutout switch in the control breaker panel located to rear of engineer's position, pantograph end.

4. Locking cover over coupling and uncoupling lever
in vestibule of MP85BE1 and MP85CE1 cars should be locked at all times when not in use.

5. Cars with inoperative motors may be placed in trains at terminals only when necessary to move inoperative cars to shops for repairs. In extreme cases of deranged car supply to avoid serious delays cars with inoperative motors may be used in the ratio of two (2) live cars to one (1) dead car, but under no circumstances should this ratio be exceeded. Dead MP85E-AE (pioneer) cars must be handled in the same ratio as MP54 cars.

6. Cars in serviceable condition and properly arranged for movement dead in train may be operated in a passenger or freight train at maximum speed as specified in the timetable.

7. MP85BE1 and MP85CE1 cars are equipped with automatic air and electric trainline couplers, a device located directly below and rigidly attached to the mechanical coupler. The purpose of the coupler is to automatically complete the air and electrical control circuits between one unit of equipment and another whenever units are mechanically coupled.

8. Cars with automatic couplers employ a drum switch at either end of the car for the purpose of breaking the electric circuit and closing the air lines to the couplers when cars are uncoupled. After coupling has been made, coupling levers on both cars should be moved to the couple position in order to ensure that the drum switch is closed and air and electric control continuity exists.

9. Prior to coupling units of equipment, visual inspection should be made to ascertain that mechanical couplers are properly aligned. Coupling cars on which mechanical couplers are misaligned should not be attempted as serious damage may result to electric couplers.

10. Coupling should not be attempted at speeds in excess of 2 mph as serious damage may result to electric couplers.

RESUSCITATION FROM ELECTRIC SHOCK AND APPARENT DEATH

General

1. The general use of electricity about railroad property makes it desirable that all employes be trained to render intelligent assistance in electric accidents. Supervisory, Class A, B, and C, and certain other employes
must be given instructions and qualify in the methods to be followed and the precautions to be observed. In event of an accident, one employe should take charge and select as assistants only those most likely to remain calm and dependable.

2. Artificial respiration, or forced breathing, is usually required in electric shock or asphyxiation by gases in manholes or resulting from the use of fire extinguishers in confined spaces; in other words, in all cases in which breathing is temporarily suspended.

3. It is highly important that some one, thoroughly familiar with the methods to be followed and the precautions to be observed, take charge and direct operations when an accident occurs. The person in charge should select as assistants only those who are most likely to remain calm in such an emergency, and who may be depended upon to give intelligent assistance.

4. Prompt and intelligently directed and continued efforts in restoring natural respiration, are necessary for successful results. While promptness is essential, undue haste should be avoided. The failure of the victim to respond quickly to resuscitation should not cause discouragement; the effort should be continued, because:

(a) The body depends upon a continuous exchange of air. We must breathe in and out about fifteen times per minute.

(b) If the body is not repeatedly supplied with air, suffocation occurs.

(c) Persons whose breathing has been stopped have been restored after artificial respiration has been continued as long as three hours or more.

5. Electric shock is not always fatal; it may only stun the victim and stop his breathing. Send for a physician promptly and put the case in his hands upon his arrival. However, since the brain cells begin to die after 4 minutes without oxygen, artificial respiration must be started immediately after his body is released from contact with a live conductor.

Electric Shock

Instructions for Releasing Victim from Contact with a Live Conductor

1. Extreme care must be exercised in releasing the victim from contact with a live conductor, to avoid receiv-
ing a shock yourself. Many persons, by their lack of knowledge of such matters, have been severely shocked or burned.

2. Release of victim from contact with live conductors if known to be 750 volts or less:

(a) Do not touch the live conductor.

(b) Do not touch the victim on his bare skin while he is in contact with the live conductor.

(c) Use a piece of DRY non-conducting material such as a piece of wood, rope, a coat, or rubber hose to push or pull the live conductor away from the victim. The live conductor may be handled safely with rubber gloves, or

(d) If the victim's clothing is dry, he should be dragged away from the live conductor by grasping his clothes, NOT HIS BARE SKIN. In doing this, the rescuer should stand on a dry board and use only one hand. Do not stand in a puddle of water or on damp or wet ground.

3. Release of victim from contact with live conductors of unknown or more than 750 volts:

(a) Do not touch the live conductor.

(b) Do not touch ANY part of the victim as long as he is in contact with the live conductor.

(c) Use a treated wood pantograph or switch pole to push the wire away from the victim. Keep the hands at least six (6) feet away from the victim and wire when doing this. Treated wood poles may be found in all substations, wire trains, and at communication and signal foreman's headquarters.

(d) If such a pole is not available, get the wire de-energized as promptly as possible by grounding the wire if rescuer knows how, or notify the power director, nearest signalman, or electrician before attempting to release the victim. When permission has been obtained from the power director, nearest signalman, or electrician, use a dry piece of wood, a rope, a coat, or rubber hose to push or pull the conductor away from the victim.
(e) If the victim or the live wire is in a pool of water, do not step into the water. Remove the victim or the live wire with the pole.

4. When handling a live wire or other conductor, be careful to see that it does not come in contact with yourself or bystanders.

5. Send for a physician promptly, preferably a company physician, and put the case in his hands upon arrival.

Artificial Respiration

General

1. If the victim can be made to breathe and to continue to breathe, the major part of resuscitation has been accomplished, and recovery is practically assured. Having freed the victim from contact with the live conductor, remove him from the water or from presence of poisonous gas, start artificial respiration immediately; do not wait for the physician. Resuscitation may be delayed or discontinued only long enough to carry the victim to a convenient spot where fresh air is abundant or to remove him to or from a train, and then only for the shortest possible time. Bystanders must not be permitted to collect closely about the victim; this prevents his getting fresh air.

2. If the accident happens on a train, remove the victim to the baggage car. If it happens on the right-of-way between stations, flag a train and place the victim in the baggage car. Open the doors and ventilators to admit fresh air. Upon the arrival of the train at the first station where a physician is at hand, turn the case over to him and render him whatever assistance he may require to continue artificial respiration.

3. Quickly feel with your fingers and remove from the victim's mouth and throat any foreign body such as tobacco, false teeth, etc.

Do not stop to loosen the victim's clothing at this time; every moment of delay is serious. Apply artificial respiration as outlined below.

Mouth-To-Mouth Artificial Respiration

The preferred method of artificial respiration is that of mouth-to-mouth, or mouth-to-nose.
A description of the method follows:

(a) Place victim on his back on the floor or ground.

(b) The operator kneels at the side of the victim, opposite the victim's head.

(c) The victim's head is rolled back as far as possible to lift tongue off the wind pipe.

(d) When possible, his mouth is quickly explored with fingers and obstructions caused by false teeth, tobacco, etc., are removed.

(e) With his free hand, the operator reaches down along the victim's nose, and gently but firmly pinches the nostrils closed.

(f) The operator places his own widely opened mouth at right angles to the victim's mouth covering it completely and with enough pressure to give a tight seal. Those who do not wish to come in contact with the person may lay a cloth or handkerchief over the victim's mouth and breathe through it. The cloth does not greatly affect the exchange of air.

(g) The operator blows into the mouth (and thence into the lungs) of the victim, watching out of the corner of his eye for the victim's chest to rise. If it doesn't, roll the head back farther and maintain position forcefully.

(h) The operator then lifts his mouth from that of the victim and draws his own breath. At the same time, the elasticity of the victim's chest wall will cause the victim to exhale. This expiratory phase should be audible to the operator.

(i) If for any reason air cannot be forced in through the mouth, it should be held tightly shut and the nose should be covered by the operator's mouth and used to force air into the lungs. Here too, the head must be rolled back into extreme extension to lift the tongue and so to permit air to enter the lungs.
RESCUE BREATHING

(j) Steps (f), (g) and (h) should be repeated about 15 to 20 times per minute. If the operator becomes a little dizzy, he is probably going too fast and should slow down a bit.

(k) Efforts to resuscitate the victim should be continued by members of the team taking turns until the arrival of a physician. If the efforts are successful, the victim should soon begin to breathe again. Even if this is not perceptible, if his color returns to normal and stays normal, he is getting the air needed and should recover.

ALTERNATIVE METHOD OF ARTIFICIAL RESPIRATION
BACK PRESSURE-ARM LIFT METHOD

Position of the Subject. Place the subject in the face down (prone) position. It is all-important that artificial respiration, when needed, be started quickly. If possible the body should be inclined slightly toward the head. The subject's head should be extended, and the chin should not sag. Bend his elbows and place his hands one upon the other. Turn his face to one side, placing the cheekbone upon his hands.

Position of the Operator. Kneel at the head of the subject on either your right or left knee. Place your knee close to his arm and just at the side of his head. Place your opposite foot near his elbow. If it is more comfortable, kneel on both knees, one on either side of the subject's head.

Place your hands upon the flat of the subject's back so that the heels of the hands lie just below a line running between the armpits. With the tips of your thumbs just touching, spread the fingers downward and outward. See Figure 1.
Position of the Operator

Fig. 1

Compression Phase

Fig. 2

Compression Phase. Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert slow, steady, even pressure downward upon your hands. This forces air out of his lungs. Your elbows should be kept straight and the pressure exerted almost directly downward on the back. See Figure 2.

Expansion Phase. Release the pressure by removing the hands from the back without giving any extra push with the release and rock slowly backward. As you rock backward grasp the subject’s arms just above his elbows and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the subject’s shoulders. Do not bend your elbows. Now drop his arms to the ground. The arm lift expands his chest by pulling on the chest muscles, arching the back, and relieving the weight on his chest. See Figures 3 and 4.

Expansion Phase

Fig. 3

Expansion Phase

Fig. 4

This completes the full cycle. The cycle should be repeated twelve times a minute at a steady, uniform rate. The compression and expansion phase should take about equal time with short release periods.
4. Continue artificial respiration without interruption for at least three hours, or until natural breathing is restored. Continue the movement for some time after natural breathing has begun. In continuing the movement be careful to keep your movements in step with the natural breathing of the victim. In stopping the movement see that the victim continues to breathe; if he stops, start artificial respiration again.

5. Do not give any liquids by mouth until the victim is fully conscious. A physician only may administer stimulant; this should not be attempted by any other person.

**CARE OF THE VICTIM**

**First Aid Treatment for Burns and Scalds**

1. In handling the victim, do not touch or irritate burned parts if possible, and during artificial respiration see that pressure is not brought to bear upon burns.

2. During the period of restoring natural respiration, an assistant should keep the victim warm by applying a cover and by laying bottles or rubber bags filled with warm, not hot, water beside the body.

3. When natural respiration has been restored, the victim should be watched carefully to see that he does not exert himself except in moderation. Violent exertion is liable to cause a cessation of breathing, recovery from which is doubtful.

4. Burns, if serious, should be cared for until a physician arrives.

5. Do not open blisters.

6. A raw or blistered surface should be protected from the air. If clothing sticks, cut around it; do not peel it off. Burns should be kept clean by applying sterile gauze compresses from the First Aid Kit, only for protection against infection. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs, or other soft cloth, and hold lightly in place by a bandage.

7. Similar coverings should be lightly bandaged over dry, charred burns, but without applying oil or other liquid dressing.

8. Send for physician, or if conscious and able to be transported, take to Company Surgeon or Emergency Room of nearest hospital.
EXTINGUISHING FIRES

1. Fire extinguishing apparatus should be ready for service at all times.

2. Fires in proximity to overhead wires may interrupt power and must be reported immediately to the Superintendent who will advise the power director, who will when necessary send a Class A employee to the scene of the fire. When power may be interrupted by fire or when fire fighting apparatus, hose streams, etc., may come in contact with overhead wires or third rail, power must be removed. If grounding of the overhead wires is necessary, it must be done by a Class A employee.

3. In case of fire on electric equipment or electrical apparatus, the power must be removed at once. The circuit must be grounded, if possible, before using fire extinguishers. If the extent of the fire requires calling private or public fire departments, they must be advised whether the equipment or apparatus is energized, deenergized and not grounded, or deenergized and grounded.

4. During a fire, all persons must keep as far as possible from energized high voltage conductors which might fall. Arrangements must be made to have such wires de-energized and grounded.

5. When using extinguishers, the operator must consider all electrical apparatus and wires energized until it is known that proper grounds have been applied, and must not approach within distances specified in these instructions. When discharging an extinguisher on a fire, the contents should be directed at the base of flames. After its use, a report should be made to the proper authority and the extinguisher recharged immediately.

6. Use of hand extinguishers for fires around electrical circuits, unless approved for that purpose, is prohibited. Follow instructions applying to the particular make of extinguishers. When using chemical extinguishers, use care to avoid being overcome by the fumes.

7. Carbon Dioxide (CO₂) Extinguishers can be used on fires involving electrical apparatus, circuits, oil or grease. Carbon dioxide is in gaseous form and appears as a vapor when released from extinguishers. It is not a conductor of electricity and the “snow” sometimes discharged will not injure or corrode apparatus. As the discharge range of the gas from this extinguisher is approximately eight (8) feet to ten (10) feet and as the discharge rate is very rapid, the operator of the extinguisher should endeavor to approach fire with any air current at his back and get as close as possible before opening control valve.

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8. Foam Type Extinguishers are effective on fires involving oil, grease, and ordinary combustible material. They are injurious to electrical apparatus and wiring. They should not be used on electrical apparatus unless carbon dioxide extinguishers are not available or have been exhausted. The stream from a foam type extinguisher is a conductor of electricity and must not be used on energized apparatus or circuits. However, if the oil from a circuit breaker or transformer is flowing and has caught fire, this extinguisher could be used thereon. The foam stream should be directed in such a manner that the foam will flow over burning oil surface. Effective range of the stream is twenty (20) to twenty-five (25) feet.

9. Dry Chemical Type Extinguishers are effective on electrical apparatus, oil, and grease fires. The dry chemical is a powder and appears as a vapor when discharged from the extinguisher. It is not a conductor of electricity. The range is approximately twenty (20) to twenty-five (25) feet.

10. Soda and Acid Extinguishers are effective on fires involving ordinary combustible material. These extinguishers are injurious to electrical apparatus and circuits. They should NOT be used on electrical apparatus unless the carbon dioxide extinguishers are not available or have been exhausted.

11. Class E44 engines are equipped with fixed extinguisher system apparatus. Compartments on these engines can be flooded with carbon dioxide by pulling release rings at any one of the pull-box stations located within the cabs or on the sides of these engines. Pantographs must be lowered, blowers allowed to stop, and compartments closed if possible before fixed systems are used. Portable fire extinguishers are provided on all of these engines for small fires, the extent of which is limited, and for fires outside of the protected compartments.

12. Oil Circuit Breaker and Transformer Fires may cause burning oil to be thrown on other electrical apparatus, and to flow through indoor floor openings. Carbon dioxide extinguishers should be used for first application, followed by the use of sand or earth to prevent fire spreading on the floor or ground.

13. Foam type extinguisher may be used only if necessary, where it can be applied to burning surfaces and inside of tanks. Where piping systems permit, return oil to drainage tank.

14. For air-cooled apparatus, including transformers and rotating machinery, stop all air-cooling appliances and close dampers before applying extinguisher to burning parts.