THE PENNSYLVANIA RAILROAD

ELECTRICAL OPERATING INSTRUCTIONS

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ELECTRICAL OPERATING

INSTRUCTIONS

REVISED
March 1, 1960

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 card (G51) must be signed by each employe receiving these instructions and forwarded to the Superintendent Transportation.

N. L. FLECKENSTINE,
Regional Manager, New York Region.

G. C. VAUGHAN,
Regional Manager, Phila. Region.

J. D. MORRIS,
Regional Manager, Chesapeake Region.

Approved:

A. M. HARRIS,
General Manager Transportation.

L. E. GINGERICH,
Chief Mechanical Officer.

C. J. HENRY,
Chief Engineer.

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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. Employes must also be familiar with the Safety Rules. 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 Transportation.

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. The location and jurisdiction of power directors are specified on the time-table.

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.

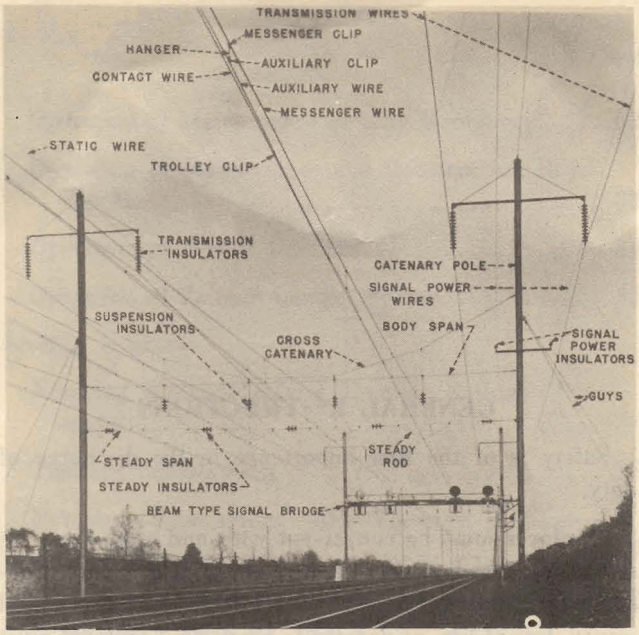


Figure 1 Overhead Electrification

GENERAL DEFINITIONS

Electrified Territory. That portion of the railroad consisting of main tracks, secondary tracks, sidings, yards, and industrial tracks 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, 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,

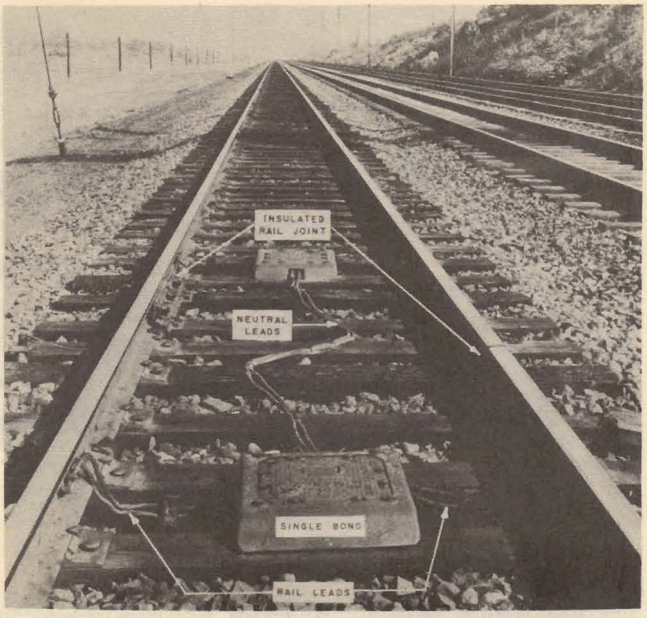


Figure 2 Impedance Bonds

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.

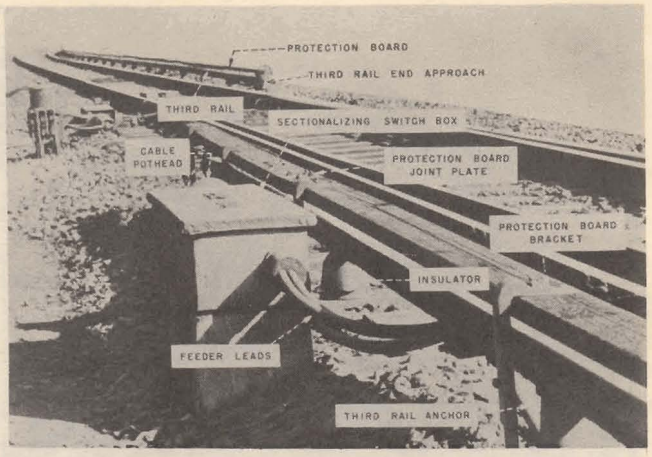


Figure 3 Third Rail

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.

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.

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.

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.

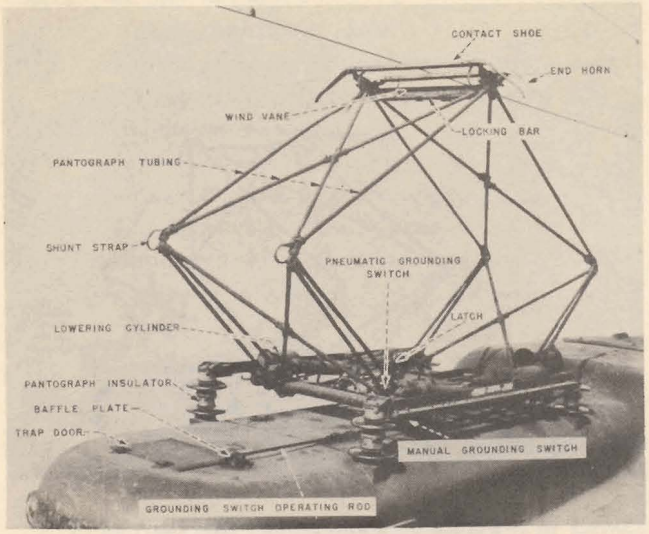


Figure 4 Pantograph—Electric Engine

Bus Jumper. A cable or jumper located adjacent to draft gear used to transmit power from one unit of electric equipment to another.

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

Superintendent Transportation. As referred to in these instructions, the Superintendent Transportation 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, track foremen, and approved employes permitted to operate machinery in Maintenance of Way Service under the conditions hereafter authorized in these instructions.

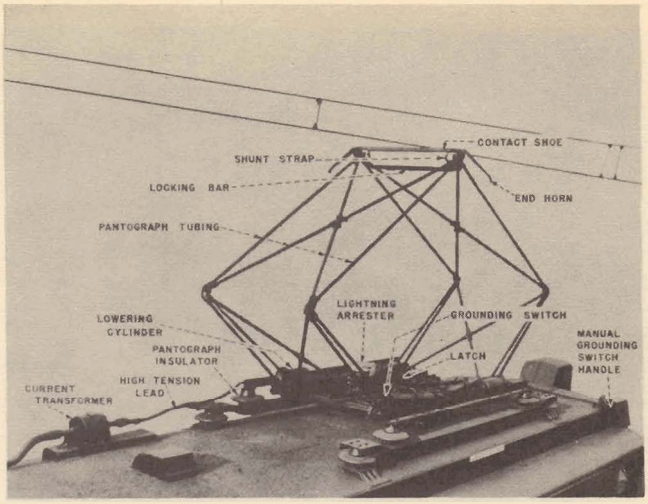


Figure 5 Pantograph—MU Car

ELECTRICAL INSTRUCTIONS

Energized (Live) Circuits

1. Tracks equipped for electrical operation are specified on the time-table.

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 employe, all persons excepting Class A employes 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 employe. Contact must never be made between the energized third rail and the track rails or ground. 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 Transportation.

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 10.

2. Employes 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 Transportation and should, if possible, leave some one to protect such wires or foreign objects until their removal. Other persons in danger must be warned of their location.

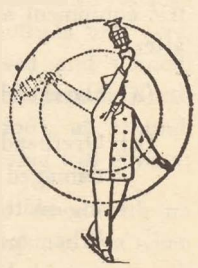
3. Loose or broken impedance bond connections in the tracks must be regarded as energized (live) and reported immediately to the Superintendent Transportation.

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

2. Condition of pantographs should be observed frequently. In case of a defective pantograph, report should be made to the Superintendent Transportation.

3. Under normal operation of single or coupled electric engines, rear pantograph shall be up on each engine. When a rear pantograph is defective, it shall be down and the front pantograph shall be up. When engines are coupled, the front pantograph of a trailing engine should not be up while the rear pantograph of the adjoining leading engine is up, when it can be avoided.

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 Transportation.

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. Class A and B employes 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.

8. 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.

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

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

11. 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.

12. 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 Region), 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.

13. 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.

14. 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 Transportation 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 Transportation.

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 should be left in the IN 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 below 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 must be in the IN 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, who must be thoroughly conversant with these instructions and with safety rules applying to his class. Copies of this book and safety rule book must be in his possession at all times while on duty.

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.

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 of a-c electric engines are applied or removed.

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 employe 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 employes doing work or cleaning, except that personal danger tags may be applied only by employe definitely assigned to prepare engine or car for other employes to perform this work. In the latter case, other employes performing this work must obtain permission from assigned employe before starting work and must advise assigned employe when work is completed. Personal danger tags must be removed by employes who applied them. Grounding switches must not be opened until tags are removed and it is 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 employe must deenergize and ground the overhead wire before any other employe may work on the engine, except when permanently grounded section is provided.

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

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

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

Assigned employe 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 removed 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 removed to a safe distance from the wires to be energized, before removing 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. At certain locations, on main tracks, sidings, secondary tracks, storage and classification yards where minimum clearance of approximately 24 feet, 6 inches, is provided between contact wire and top of rail, qualified employes are permitted to ride or work upon top of cars and other equipment in the performance of their duties, not permitting any part of their bodies, clothing, tools, or material to get closer than three (3) feet to wires. Such locations are designated HIGH WIRE territory, limits of which are marked by HIGH WIRE and LOW WIRE signs.

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 over main tracks, secondary tracks, running tracks, sidings, and yards 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. Unless special authority is granted, not more than two persons, in addition to engine crew, are permitted to ride on front platform of multiple unit trains or in operating compartment of electric engines.

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

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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 engineman's hand and/or foot is removed.

10. In the event "Deadman" safety control fails on multiple unit cars or electric engines, the train may proceed when authorized by the Superintendent Transportation. Engineman will report occurrence on prescribed M.P. form, without delay to train.

11. Electric engines operating in yard service must have emergency train brake attachment made inoperative.

12. 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.

13. 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 wire on certain industrial tracks is normally deenergized.

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

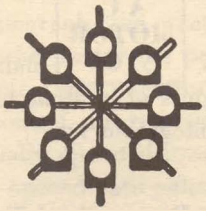
1. When necessary to deenergize catenary wires over any track under the jurisdiction of a train dispatcher, train director, yard master, enginehouse foreman (their assistants, or other authorized employes, except at certain locations specified by the Superintendent Transportation), a plate order form 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 **P B** 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 on the time-table.

Dead Sections

1. Dead sections are installed in overhead wires at certain locations specified on the time-table. The limits of these sections are designated by dead section signs—**D S**.

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. The first indication of sleet shall be reported promptly to the Superintendent Transportation 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 multiple unit 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 released 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. When excessive arcing occurs due to sleet formation, double pantograph operation shall be made effective without double pantograph order.

5. 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 employe, 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.

6. Two electric engines coupled, 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.

7. 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.

8. Electrified sidings and yard tracks will be given required attention with patrol trains.

9. 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.

10. Wire trains will be manned and held available at advantageous points for immediate call during sleet storms.

11. During sleet storms, pantograph shoes of all electric engines in passenger and freight service will be inspected at locations specified on the time-table.

12. 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 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 must be in the IN 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.

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

13. 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 instructions.

14. 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. During the interval that pantograph is down, manual control of the boiler should be used along with the stack blower to permit operating without power.

Third Rail

1. The third rail is divided into sections and the power supply is controlled by circuit breakers and sectionalizing switches. Third rail on all main tracks, secondary tracks, running tracks, sidings, and yards, 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 Transportation.

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 Transportation.

6. Emergency jumpers are kept at places designated on the time-table 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 Transportation 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 Transportation or the 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, the boom must be 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 mobile and crawler boom cranes and similar roadway machines are used in proximity to overhead electrification wires, power wires, and electrical apparatus, the boom and supporting frames of such machines must be properly grounded in accordance with drawing D-448643, latest issue.

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 Transportation 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 Transportation 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 employe. 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 employes 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 employe 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 employe 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, employe 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, employe 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 employe placing tag.

(e) Time and date tag is placed.

(f) Location.

Employe 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, employe shall remove tags and write thereon the following:

(a) Time and date tag is removed.

(b) Name of employe 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, P5 and P5a Engines

	Between New York-Washington Both Directions Harrisburg-Phila. Eastward Paoli-Harrisburg Westward		Between Philadelphia or North Philadelphia and Paoli—Westward	
Notching Restrictions	Tons	Maximum Cars	Tons	Maximum Cars
None	1445 or Less	20	1330 or Less	20
18th Notch	1446 to 1750	27	1331 to 1600	27
16th Notch	1751 to 2500	30	1601 to 2000	30

Type O1 Engines

Class	O1a	O1c
Notching Restrictions	Tons	Tons
20th Notch	...	675
18th Notch	670	740
17th Notch	...	780
16th Notch	750	815
15th Notch	785	...
14th Notch	825	...

When the tonnage or the number of cars of a train exceeds values specified above, the train should be doubleheaded. 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 percentage of the above tonnage ratings as follows:

Type of Engine	Per Cent of Tonnage Rating
GG1	60
L6, L6a, P5, P5a,	40
O1	30

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 per cent 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 per cent 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—Transportation 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 Region) without doubleheading.

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

Tonnage Computation

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

Type of Car	Tons Empty	Tons Loaded	
		Mail Service	Baggage and Express Service
Baggage (B60 & Foreign)	55	75	65
Refrigerator (R50B & Foreign)			
Baggage (B70)	60	85	75
Baggage (B74)	65	..	80
Baggage, Mail (BM70 & M70)	70	80	..
Express (X29)	25	50	40
	Tons Empty	Tons Loaded	Note
Pass. Baggage (PB70)	80	90	B
Lightweight Coach (P85)			
Observation Coach			
Lightweight Cafe, Cafe	70	80	B
Lounge, Lounge			
Baggage, Bagg. Dormitory			
Coaches, all others	65	70	A
Diner Twin Unit Heavy Type	180	180	B
Diner Twin Unit Lightweight	155	155	B
Diner & Standard Pullman	95	95	B
Diner Lightweight & Pullman Lightweight	65	65	B
Business Cars	95	95	B

NOTE: For Air Conditioning
A—When car is equipped, add ten (10) tons.
B—Weight has been included.:

Notching Restrictions and Tonnage Ratings—Freight

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

P5, P5a, ...18th Notch
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, except Class E2B engines may be operated in weak field for a period not to exceed ten minutes.

Flat Tons—One Engine

	Direction	P5 P5a	GG1 90 mph	DD2	P5b	E2B	E2C E3B	FF2	Note
Potomac Yard-Bay View	N	2850	3550	3800	4050	2450	3900	—	—
	S	1600	2100	2100	2200	1600	2550	—	—
	S	3400	3800	3800	4000	3400	4150	—	A
Bay View-Edge Moor	N	4900	4700	5800	6200	3700	5550	—	—
	S	3850	4100	4850	5150	3050	4600	—	—
Edge Moor-Grays Ferry	N	4900	4700	5800	6200	3700	5550	3500	—
	S	3850	4400	4850	5150	3050	4600	4650	B
Grays Ferry-Jersey City Terminals	E	4900	4700	5800	6200	3700	5550	—	—
	E	5450	5250	6500	6900	4150	6200	—	M
	W	3850	4200	4850	5150	3050	4600	—	—
Enola-Jersey City Terminals & So. Amboy via Low Grade	E	4350	4250	5700	6050	3900	6000	—	E
	E	5000	4800	6400	6800	4400	6700	—	M,E
	W	3000	2900	3300	3500	2350	3500	—	F
Enola-Philadelphia via Low Grade	E	3000	3400	3850	3900	2350	4100	3300	—
	E	4350	4250	5700	6050	3900	6000	4950	G
	E	3350	3800	4000	4350	2650	4600	3650	M
	E	5000	4800	6400	6800	4400	6700	5750	M,G
	W	1500	1700	2050	2150	1300	2350	2150	—
	W	3000	2900	3300	3500	2350	3500	3250	H
	W	3300	3200	—	—	—	—	3600	M,K
Harrisburg-Philadelphia via Main Line	E	3000	3400	3550	3900	2350	4100	3300	—
	E	3350	3800	4000	4350	2650	4600	3650	M
	W	3000	2900	3300	3500	2350	3500	3250	H
	W	3300	3200	—	—	—	—	3600	M,K
Harrisburg-Philadelphia via Columbia Branch	E	2200	2500	3000	3300	1900	3700	2850	—
	E	2500	2850	3350	3700	2150	4150	3100	M
	W	3000	2900	3300	3500	2350	3500	3250	H
	W	3300	3200	—	—	—	—	3600	M,K
Enola-Bay View	E	3350	3600	—	—	3000	5650	3650	—
	E	5000	4950	5700	6050	3550	6000	4900	I
	E	5600	5500	6400	6800	4000	6700	5400	M,I
	W	4150	4150	5050	5350	3200	5550	3600	—
	W	4800	4800	5850	6150	3700	6400	3900	M
Enola-Edge Moor	E	3350	3600	—	—	3000	5500	—	—
	E	4550	4700	5450	5800	3450	—	—	I
	W	3750	3800	4650	4900	2900	4200	—	—
Frankford Junction-Pavonia	E	1800	2450	3050	3050	1900	3300	—	—
	E	3100	3400	4000	4000	2400	—	—	J
	W	1350	1650	2000	2000	1250	2050	—	—
	W	1950	2100	2500	2500	1550	—	—	J
South Phila.-52nd Street Yard	W	4250	4200	—	—	3300	6650	4900	—
	W	4400	4550	—	—	3350	7600	5150	M

Flat Tons—Two Engines

	Direction	P5 P5a	GG1 90 mph	E2B	E2C E3B	Note
Potomac Yard-Bay View	N	5700	7100	5700	8550	—
	S	3400	4400	3400	5500	—
	S	5200	6000	5200	7050	A
Bay View-Edge Moor	N	9800	9400	7400	11100	—
	S	7700	8200	6100	9200	—
Edge Moor-Grays Ferry	N	9800	9400	7400	11100	—
	S	7700	8800	6100	9200	B
Grays Ferry-Jersey City Terminals	E	9800	9400	7400	11100	—
	E	10900	10500	8300	12400	M
	W	7700	8400	6100	9200	—
Enola-Jersey City Terminals & So. Amboy via Low Grade	E	8700	8500	7800	12000	E
	E	10000	9600	8800	13400	M,E
	W	6000	5800	4700	7000	F
Enola-Philadelphia via Low Grade	E	6000	6800	5300	8200	—
	E	8700	8500	7800	11200	G
	E	6700	7600	5900	9200	M
	E	10000	9600	8800	12550	M,G
	W	3000	3400	3100	4700	—
	W	4500	4750	4450	6050	H
	W	4950	4900	—	—	M,K
	W	—	—	4700	8000	M,2K
Harrisburg-Philadelphia via Main Line	E	6000	6800	5300	8200	—
	E	6700	7600	5900	9200	M
	W	4500	4750	4450	6050	H
	W	4950	4900	—	—	M,K
Harrisburg-Philadelphia via Columbia Branch	E	4400	5000	4300	7400	—
	E	5000	5700	4800	8300	M
	W	4500	4750	4450	6050	H
	W	4950	4900	—	—	M,K
Enola-Bay View	E	6700	7200	6000	11300	—
	E	10000	9900	7850	12000	I
	E	11200	11000	8800	13400	M,I
	W	8300	8300	6400	11100	—
	W	9600	9600	7400	12800	M
Enola-Edge Moor	E	6700	7200	6000	11000	—
	E	9100	9400	6900	—	I
	W	7500	7600	5800	8400	—
Frankford Junction-Pavonia	E	6200	6800	4800	7200	—
	W	3900	4200	3100	4650	—
South Phila.-52nd Street Yard	W	8500	8400	6600	13000	—
	W	8800	9100	6700	15000	M
Enola-South Phila. via Perryville	E	10000	—	—	—	M,I
	W	8600	8600	—	—	M,C

NOTE M: Ratings thus marked may be used only for trains with average weight per car exceeding 80 tons.

NOTES A to K, inclusive: Helper required (P5, P5a, P5b or equivalent).

A. Bay View to Fulton.
B. Grays Ferry, if stopped.
C. Grays Ferry-North Philadelphia, if stopped.
D. Waverly Yard.
E. Brown-South Amboy.
F. South Amboy-Brown; and Morrisville Yard, if stopped.
G. Thorndale-Paoli.
H. 52nd Street-Bryn Mawr.
I. Perryville, if stopped.
J. Delaware River Bridge Approach, if stopped.
K. 52nd Street-Paoli.

Flat Tons—Three Engines

	Direction	P5 P5a	GG1 90 mph	E2B	E2C E3B	Note
South Phila.-	W	8800	8100	8000	10000	M,2K,L
Enola	W	6600	—	6400	—	M,K
via Low Grade	W	6900	—	—	—	M,N,L
	W	7900	—	—	—	M,O,L

Note M: Ratings thus marked may be used only for trains with average weight per car exceeding 80 tons.

Notes A to L, inclusive: Helper required (Class P5, BS-24m or equivalent unless otherwise noted); prefix 2 indicates two helpers required.

A. B. & P. Junction to Fulton.
B. Grays Ferry, if stopped.
C. South Philadelphia to Grays Ferry.
D.
E. Brown to South Amboy.
F. South Amboy to Brown; and Morrisville Yard, if stopped.
G. Thorndale to Paoli.
H. 52nd Street to Bryn Mawr.
I. Perryville, if stopped.
J. Delaware River Bridge approach, if stopped.
K. 52nd Street to Paoli.
L. Thorndale to Parkesburg, when rails are wet.

N. GG1 helper, 52nd Street to Paoli.
O. 2 units E2B helper, 52nd Street to Paoli.

3. Electric engines, in freight service with one motor circuit cut out, are limited to percentage of the above tonnage ratings as follows:

Type of Engine	Per Cent of Tonnage Rating
FF2, GG1	60
P5, P5a, P5b	40
DD2	40
E2B	40
E2C, E3B	80

4. With type FF2, GG1, P5, P5a, P5b, or DD2 engines, on the grade from Columbia to Atglen—A. & S. Branch—(Philadelphia Region):

Trains having tonnage over 90 per cent of engine rating:

Speed is limited to thirty-five (35) miles per hour; unless stopped at or passing either Columbia or Port at less than twenty-five (25) miles per hour, in which case speed is limited to thirty (30) miles per hour.

Trains having tonnage not more than 90 per cent of engine rating:

Speed is limited to forty (40) miles per hour, unless stopped at or passing either Columbia or Port at less than twenty-five (25) miles per hour, in which case speed is limited to thirty-five (35) miles per hour.

5. Electric engines assigned to passenger service for which no freight tonnage rating is specified shall not be used in freight service. Other electric engines assigned to passenger service may be used on freight trains in emergency, observing tonnage ratings and notching restrictions in effect for those engines in freight service.

Weight of Electric Engines Hauled Dead in Trains

Type of Engine	Tons
DD2	225
E2B	123
E2C	185
E3B	189
FF2	260
GG1	239
L6, L6a	153
O1a, O1c	155
P5, P5a	197
P5b	222

Authorized Current Ratings

Type	Overload Relay Setting	Maximum Accelerating Current	
	Amperes	Amperes	Ten minutes One hour
DD2	3600	Below 3600	Starting
	Thermal	3800	Weak field 10 min.
		3100	Full field 1-16
		2800	17-21
E2C, E3B	1400	1275	Starting
FF2	850	700	Starting 5 min.
		500	1-24
		400	25 and above
GG1 (90 mph) (4801-4857)	2750	Below 2750	Starting
		2300	1-17
		2000	18-22
GG1 (100 mph) 4800, 4858-4938)	3000	Below 3000	Starting
		2500	1-17
		2200	18-22
L6, L6a	4100	4000	1-16
		3500	17-20
O1a	4500	4000	....
O1c	4600	4000	1-16
		3500	17-20
P5, P5a, P5b	4000	Below 4000	1-16
		3500	17-18

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

Multiple Operation

1. Electric engines may be operated in multiple by use of control jumpers only as follows:

E2B with E2B, P5, or P5a,
E2C with E2C or E3B
E3B with E3B or E2C
GG1 with GG1
L6 with L6 or L6a
L6a with L6
P5 with P5a or E2B
P5a with P5, P5a, or E2B

Snow Screens

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

2. Engines hauling passenger trains may have the snow screens applied at station stops or while the engines are drifting enroute.

3. Engines hauling freight trains may have the snow screens applied when the trains stop at convenient location or while the engines are drifting enroute.

Steam Heating Boilers

1. After preparation of boiler, the fire should be extinguished if practicable, to prevent unnecessary use of oil and water.

2. The boiler shall be put in service, and sufficient water and steam pressure obtained prior to coupling engine to train. In freezing weather, sufficient steam should be passed from the end valves to the atmosphere to prevent freezing.

3. Where no discomfort to passengers will result, steam should be shut off train and boiler fire extinguished in advance of arrival at terminal. Where engine crew is changed at intermediate points steam should not be shut off.

4. Failure to heat train properly, with the cause, shall be reported to the Superintendent Transportation from first convenient location.

5. To avoid power interruption, fire shall be extinguished and burner decarbonized as follows:

(a) Crack decarbonizing valve until flame starts to flicker, then close oil valve.

(b) Open decarbonizing valve and decarbonize burner.

(c) Cycle combustion controller to high flame position and scavenge fire box of all gases.

6. Seven sounds on the communicating signal will indicate SHUT OFF STEAM.

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

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

MULTIPLE UNIT CARS

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 25 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 practicable, multiple unit trains arriving at yard or terminal should have pantographs lowered promptly, unless other instructions prevent.

4. When traction motors on a multiple unit car become inoperative enroute, the control cut-out switch should be opened. If difficulty is then experienced in starting the train, the current limit relay cut-out switch seals should be broken and switches closed on all operative cars so equipped. The switches should be opened as soon as conditions permit and report made at end of trip.

5. Heat numeral signs 0—1—2—3 will be displayed at locations specified on the time-table. Unless otherwise instructed by the Superintendent Transportation, 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

6. Multiple unit 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 on the time-table.

7. 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:

Outside Temperature	Time Required
5 degrees	2 hours, 10 minutes
15 degrees	1 hour, 50 minutes
25 degrees	1 hour, 25 minutes
35 degrees	50 minutes
45 degrees	25 minutes
55 degrees	10 minutes

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

9. Multiple unit cars equipped with small pantographs (having maximum operating height of less than 24 feet, 6 inches) shall not be operated in high wire territory with pantographs up.

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

11. 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 drop window in the side door should be closed.

12. When making movements of multiple unit cars with two enginemen, 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 movement is started in the opposite direction. This is necessary in order to have full control of the air brakes at the end from which the train is operated.

13. When power is shut off motors on a multiple unit train moving at speed in excess of thirty (30) miles per hour, power should 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 on the consist. This is necessary to prevent motors from flashing over.

14. Multiple unit 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:

Total Number of Cars in Train	4	5	6	7	8	9	10	11	12	13	14
Between	Number of Inoperative Cars										
Jersey City–New Brunswick–Trenton–Phila.–South Amboy	0	1	1	2	2	2	3	3	3	3	4
North Phila.–Chestnut Hill	0	1	1	1	1	2	3	3	3	3	3
Phila.–Norristown	0	0	1	1	1	2	3	3	3	3	3
Other Points	0	1	1	1	2	2	3	3	3	3	4

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

15. A multiple unit car may be moved dead in a passenger train at a speed of sixty-five (65) miles per hour, and in a freight train at fifty (50) miles per hour, unless the condition of the car is likely to cause damage, in which case authorized speed shall be specified by the Superintendent Transportation.

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

17. Multiple unit trains operated from any position other than front end of train must not exceed a speed of thirty (30) miles per hour.

Miscellaneous Instructions

Electric Engines—Multiple Unit Cars

1. Electric Engines and MU cars must not be operated through water, except in emergency when authorized by the Superintendent Transportation and then only as specified below:

Electric Unit—Engine classes B1, E2b, E2c, E3b, FF2, L6, L6a, P5b and MU cars may be run through water when its depth does not exceed 2 inches over top of the rail, at a speed not exceeding 2 miles per hour.

Electric Units—Engine classes DD2, GG1, P5, P5a, O1a, O1c may be run through water when its depth does not exceed 7 inches over top of rail, at a speed not exceeding 2 miles per hour.

2. All electric units, except the rectifier type class E2c and E3b, are equipped with a wheel slip warning device (light or buzzer or both) which indicates slipping or sliding of the wheels of one or more driving axles of the unit.

If the warning indication is steady or the slip relay cuts out the motor circuit making it necessary to reset the relay, it may be due to a locked driving axle caused by a broken pinion or axle gear, a frozen armature shaft due to failure of an armature bearing or other causes. In this case the train must be brought to a stop and examination made to determine whether all driving wheels are able to rotate. If any wheels are locked the unit must not be moved except in accordance with instructions from Superintendent Transportation.

No wheel slip or slide indication will be received from a traction motor circuit that has been cut out. Consequently when operating with a motor circuit cut out, frequent checks must be made to ascertain that the driving axles are not locked.

3. Engineman on each trip shall check the speed indicated on the speedometer against lapse of time and measured mile posts while equipment is being operated at constant speed and report inaccuracies on M.P. 62E form.

4. Maximum Speed Table—Unless Otherwise Restricted Electric Engines.

Class	Miles per Hour Light	Miles per Hour With Train
Electric Units:		
B1	25	25
DD1	50	50
DD2	50	70
E2B, E2C, E3B	50	60
FF2	50	50
GG1 (#4800, #4858-#4938, incl.)	50	100
GG1 (#4801-#4857, incl.)	50	90
L6, L6a	50	50
O1a, O1c	50	90
P5, P5a, P5b	50	70

5. Electric Unit Horsepower.

Class B1	570 Horsepower
Class DD1	1580 Horsepower
Class DD2	5000 Horsepower
Class E2B	2500 Horsepower
Class E2C, E3B	3000 Horsepower
Class FF2	3000 Horsepower
Class GG1	4620 Horsepower
Class L6, L6a	2500 Horsepower
Class O1a, O1c	2500 Horsepower
Class P5, P5a	3750 Horsepower
Class P5b	5350 Horsepower

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.

Electric Shock

1. Electric shock is not always fatal; it may only stun the victim and stop his breathing for a while. The shock is not likely to be immediately fatal.

2. 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.

3. 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.

4. 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.

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

6. Send for a physician promptly, preferably a com- physician, and put the case in his hands upon arrival.

Method of Artificial Respiration

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.

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 cheek-bone 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 6.

Figure 6 Position of the Operator

Figure 7 Compression Phase

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 7.

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 8 and 9.

Figure 8 Expansion Phase

Figure 9 Expansion Phase

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

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

4. Do not open blisters.

5. A raw or blistered surface should be protected from the air. If clothing sticks, cut around it; do not peel it off. A dressing of soft material should be applied to the burn, and this or the cloth adhering to the wound should be saturated with a solution of baking soda (one teaspoonful to a pint of water).

Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs, or other soft cloth, and hold lightly in place by a bandage.

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

7. After regaining consciousness, 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.

First Aid Treatment for Burns and Scalds

1. A remedy has been provided for the treatment of burns and scalds, a supply of which is kept at all substations and block stations in electrified territory.

2. Completely bandage the burn or scald with contents of First Aid Packet; follow this by thoroughly wetting the bandages, covering the injured part with the solution contained in the bottle, remembering that nothing is to be applied directly to the burn or scald except the bandage contained in the First Aid Packet.

3. It should be thoroughly understood that this preparation is not to be considered for healing purposes, but merely to save the person from pain until he can be treated by a physician.

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 Transportation who will advise the power director, who will when necessary send a Class A employe 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 employe.

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 deenergized 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 (CO_2) 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.

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. **Fixed Extinguisher Systems.** Class E2B, E2C, and E3B engines and certain Class P5a 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.