CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC RAILROAD COMPANY

ELECTRIFICATION DEPARTMENT

SUMMARY OF FATAL AND NON-FATAL ACCIDENTS WHICH HAVE OCCURRED IN CONNECTION WITH ELECTRIFICATION OPERATION

With

SAFETY FIRST SUGGESTIONS

To aid in preventing similar accidents to other employes

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Notes regarding fatalities and injuries to employes and others resulting from electric shock due to contact with electrification circuits, equipment, or machines, during the period 1915 to 1950, inclusive.

During the 36 year period 1915 to 1950, inclusive, many unfortunate accidents occurred to individuals as result of contact with electrification circuits, machines, or equipment. A glance at the chart of fatalities shown on page 1 of the following summary shows clearly that most of these fatalities occurred prior to the year 1931. A comparison of the fatalities which occurred during the two periods 1915 to 1930, inclusive, and 1931 to 1950, inclusive, emphasizes dramatically the improvement that has been accomplished by the formulation and thorough application of "Safety Rules Governing Electrification Line Crews" which were first placed in effect on March 15, 1931, and the accompanying similar safety program for substation operators.

It is unfortunate that during the early years of electrification so many fatal accidents occurred due to electric shock, and it should be borne in mind that with only slightly varying conditions, any case of electric shock could be fatal. All workmen who are exposed to possibilities of electric shock should read the following pages carefully and profit by the sad experience of many other employes over a long period of years, bearing in mind that violation of safety rules or carelessness on their part could cause a fatal or serious injury to them.

During the period 1931 to 1950, inclusive, there were no fatalities to linemen or substation operators on the Rocky Mountain Division, and only one fatality to a lineman on the Coast Division. The supervisors and employes who accomplished this excellent safety record are to be commended. It is hoped that by careful and systematic application of the principles of safety, this record may be continued indefinitely.

L. C. Wyld

Electrical Engineer.

CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC RAILROAD COMPANY
ELECTRIFICATION DEPARTMENT

CHART OF FATALITIES RESULTING FROM ELECTRIC SHOCK
ELECTRIFIED TERRITORY

Year	Rocky Mtn. Division					Coast Division				
	Line-men	Engi-neers	Host-lers	Sub. Oprs.	Misc.	Line-men	Engi-neers	Host-lers	Sub. Oprs.	Misc
1915			*							
1916			*		*					
1917		*		*						
1918										
1919										
1920	*			*	*					
1921										
1922		*					*			
1923	*				*					
1924	*		*	*						
1925										
1926										
1927	*				*					
1928				*		*				
1929	*								*	
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1944									*	
1945										
1946										
1947										
1948										
1949										
1950					*					

See details of each case on following sheets.

PART 1. FATAL ACCIDENTS WHICH HAVE OCCURRED IN CONNECTION WITH ELECTRIFICATION OPERATION

The following memoranda in connection with accidents resulting in death to employes engaged in the operation, maintenance and repair of our substations, transmission and distribution systems, has been compiled for the purpose of pointing out to other employes the mistakes contributing to these fatalities and suggested means of avoiding such accidents in the future. While in some cases there appears to have been extreme carelessness on the part of the employe killed or injured, there also exists, in many cases, the situation where, had the supervisors and fellow employes under whom and with whom these men were working given first consideration to the matter of safety, the accident would have been prevented.

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10-25-15 - Hostler Helper.

Cleaning apparatus in high tension compartment and failed to heed warning to clear locomotive and that pantograph was to be raised.

Rules have been formulated and routine prescribed during the period of experience with electrical operation which would prevent an accident of this kind and which it is the duty of supervisors to see that all men connected with locomotive maintenance or operation thoroughly understand. Strict observance of such rules and routine should be required of all concerned.

4-10-16 - Hostler Helper.

Handling sand tower pipe which came in contact with trolley wire.

This accident also occurred in tthe early period of electrical operation when the men had not yet cultivated the habit of exercising precaution with respect to coming in contact with the wires. To afford additional protection in case of careless handling, sand spout was afterwards arranged in telescopic fashion so outer end would automatically drop into lower end as pipe was raised, thus preventing contact with wire.

12-5-16 - Cinder Pit Man.

Struck trolley wire with iron cleaning rod while thawing out air pipe leading to turntable.

This accident could have been prevented by cultivation of elementary habits of precaution and by supervisor making sure employes thoroughly understood danger of contact before working under trolley or other live wires.

6-2-17 - Substation Operator.

Inhaled gas from burned copper while attempting to put out fire started by high tension arc in transformer room.

As the result of the failure of an insulator supporting the high tension bus in one of the substations, arcing occurred on the high tension bus, and heavy yellowish fumes were produced. A substation operator entered the transformer room to make repairs while these fumes were still present. He was seriously affected by the fumes but continued his operating duties that day. The following day it was necessary to take him to the hospital and shortly afterward he died.

There is some question as to how much the physical condition of the party may have contributed to the results, but in any event care should be taken to avoid the inhalation of copper fumes of this nature whose existence is plainly visible or evident to the senses. Such copper fumes and fumes from carbon-tetrachloride extinguishers are dangerous and should be avoided even if they are not so dense as to interfere with breathing. In case of serious arcing and fires, all reasonable action should be taken to cut off the current and put out the fire, but it is not desired by the Company that an employe needlessly expose himself to the possibility of serious injury.

10-8-17 - Locomotive Engineer.

A pantograph has been damaged by catching in the overhead wires, and the engineer was on the roof of the locomotive trying to get the pantograph tied down. The trolley was presumed to have been de-energized, but the trolley wire on an adjacent track was still energized, and a hanger which had been torn loose by the accident lay across both wires, energizing the wire over the pantograph. On account of its damaged condition the pantograph cleared the trolley by only about six inches. While working on it, the engineer raised it enough to contact the wire and was killed.

When working under the conditions which existed the trolley wire should have been not only de-energized but also grounded. If the wire had been grounded the cross with the energized wire would have been discovered and the condition corrected before the work on the pantograph was started.

1-26-20 - Substation Operator.

While cleaning contact on alarm bell switch which was mounted on 3000 volt machine breaker panel he apparently came in contact with a high voltage part and was killed.

The motor-generator sets were not running and therefore the voltage could have been removed from the panel worked on by proper switching. These bell contacts were at a later date all removed from the high voltage panels so that this same form of accident cannot happen again, but in any case in which work is to be done on the 3000 volt panels the circuits on the panels and any other high voltage circuits in the vicinity of the panel must be de-energized.

7-19-20 - Lineman.

Repairing trolley feeder line after poles and wires were damaged by a derailment. Was working on a pole on which cross arm braces were grounded by the derangement of the wire and was removing a tie wire from energized feeder.

Under the conditions existing work should not have been done on the pole with the wires energized. If wires cannot be de-energized, worker must apply protective insulation and wear rubber gloves as required by the safety rules. Do not sacrifice safety for the sake of saving time, even in emergency repairs.

10-12-20 - Carpenter Helper.

Inspecting roof of substation. Stepped back against high tension conductors. Was not necessary to approach conductors and reason for doing so unknown.

Take careful thought of the necessity of keeping the proper distance from energized wires. If you are not sure what is a safe distance, ask an employe qualified to know. When in charge of men working in the vicinity of energized wires, be sure they understand the danger which exists and that they know what distance they must remain from the wires. Do not require or allow a man under you to work in the vicinity of energized wires unless you know he is experienced and competent to trust in such a location.

Employes and others should not go on top of substations nor in close proximity of live apparatus or parts unless accompanied by substation operator, substation foreman, or competent person designated by them.

11-23-21 - Bridge Carpenter.

Wrecked tender on adjoining N.P. transfer track, broke guy, and disturbed overhead. Maintenance car went to make repairs, but left to answer emergency call. The crew foreman considered that condition of trolley was not dangerous and as locomotives could operate under wire, gave preference to emergency call referred to. Other calls kept crew away so that they did not make repairs until after accident mentioned had occurred. Guys, in normal position, extended down close to bridge FF-308 and while working on this several days later, carpenter in some way came in contact with guy and was killed. It developed that a live trolley part had come in contact with mast arm, and guy, being in contact with the latter where attached to pole, became emergized. Insulator in guy was broken so that guy was alive its full length.

Inasmuch as there was a broken insulator in the guy and this condition was known, the guy should have been tied up in the clear or special precautions should have been taken when the crew went to work on the bridge to see that the condition of the trolley was not such as to give rise to accident. A warning sign, suitably placed at a location such as this where the trolley system was in defective condition, and warning against contact with any wire parts, would have helped to prevent the accident. Likewise, men working in the vicinity of wires, etc, connected to electrification poles should, particularly when the trolley system is in defective condition waiting to be repaired, avoid any contact with wires or parts such as those referred to

6-2-22 - Locomotive Engineer.

Examining No. 53 contactor on motor #10306 for trouble with pantograph up, both main and auxiliary switches closed and M.G. set operating. Apparently took hold of energized portion of relay with bare hands.

Failure to observe safety-first rules, by de-energizing live parts before working on them, was responsible for this man's death.

6-28-22 - Locomotive Engineer.

Sweeping sand from top of locomotive #10225 and came in contact with span wire. Wires lower than normal height at this point on account of bridge over tracks.

Employes should not go on top of locomotive when the trolley is energized, particularly under low wire, unless absolutely necessary, and then extreme care should be used.

4-18-23 - Carpenter Helper.

While threading cable through block at top of pile driver boom, came in contact with horn attached to upper surface of insulating hood, horn being against live wire.

This cable could have been threaded through with the boom entirely away from the wire. As a result of this accident it was suggested that the metal strip which had been placed on top of the pile driver frame be removed. Another feature which contributed to this accident was the fact that at this approach to the viaduct the trolley clearance was slightly less than normal and the pile driver foreman claimed to have been unaware of this. The fact that it was the foreman's responsibility to determine the actual height of this trolley should not be construed as relieving line foreman or others familiar with the situation from calling it to his attention.

5-14-23 - Line Foreman.

Assisting lineman in making splice in energized 4400 V. signal circuit. Apparently grasped both sides of open splice.

This accident could have been avoided by either de-energizing the particular section of the circuit in which the break occurred, or by proper use of protective appliances which are provided on the maintenance cars. Indications are that if the Shafer Prone Pressure method of resuscitation had been carried on without cessation and for a longer period than was done in this case, this man might have been revived.

3-22-24 - Hostler.

Entered high tension compartment of motor with pantograph up and closed main switch with bare hands.

The man should have provided himself with pantograph handle, and, in addition, if there was any chance of other parties coming into locomotive and raising pantograph, he should have tied pantograph down before doing work in high tension compartment.

7-5-24 - Lineman.

Line crew making emergency repairs to trolley near west switch at Josephine. Lineman pulled his body up between pull-offs connected to yard trolley, which was alive, and pull-off connected to main line trolley east, which had been grounded by line trouble east a short time before accident occurred.

This is another case where suitable care was not exercised to insure that all parts being worked on or with which linemen came in contact were

of the same potential. There are ways in which this could have been done and which are known to the men working on the wires. Also the use of protective devices which the company furnishes would have prevented this accident.

8-8-24 - Substation Operator.

While standing on a ladder and making repairs to bell alarm circuit on west feeder breaker at Avery substation, left hand apparently came in contact with west disconnecting switch while his back or right shoulder was in contact with grounded "I" beam.

This is another case where it would have been entirely practicable for the operator to properly protect himself while working on the alarm circuit by throwing the proper switches, or even to have postponed repair service until all surrounding parts could have been de-energized. Also, under no circumstances should an operator or maintainer work on energized circuits of dangerous voltage or parts when alone, but should be accompanied by an assistant.

3-13-25 - Machinist Helper.

After trolley was put up, this man climbed up on "A" end of motor and was electrocuted.

This man should not have gone on top the locomotive while the pantograph was up; also it should be the duty of the engineer to see that the rule prohibiting such carelessness is strictly adhered to.

4-29-27 - Section Laborer.

Working with section crew at Janney, when he came in contact with live trolley wire.

This accident, which involved a chain of rather unusual circumstances, indicates the desirability, in case of trolley trouble resulting in the displacement of overhead parts or wires, of immediately clearing any such parts or wires that are fouling each other regardless of apparent existing insulation, since such displacement often results in the breaking down of existing insulation. If, after having taken such steps, further hazard appears to exist at the location involved, it should be guarded by some competent person until safe conditions have been established.

7-1-27 - Lineman.

Electrocuted by coming in contact with 4400 volt signal feeder and grounded signal transformer case support, while standing on a transformer arm, putting protective rubber on the signal primary.

Rubber gloves should be worn when placing rubber protection on energized wires. Live wire work should not be done on transformer poles, on account of the difficulty of providing the double insulation required by the rules.

1-26-28 - Substation Operator.

Attempted to clean 100,000 volt porcelain bushing without de-energizing the circuit.

This accident appeared to result from a disregard of even the ordinary provisions of safety. Either the man was intentionally careless in working in a dangerous position on apparatus he knew to be energized, or else he did not make sure that the apparatus was de-energized. Any part of the insulators of a high tension insulation should not be touched when energized since, due to leakage and capacity effects, there is some voltage on all parts except the grounded extreme end.

7-26-28 - Line Foreman.

Trolley wires had been damaged by pantograph and linemen were working on trolley from insulated tower making repairs. Trolley and messenger were being pulled into place so as to be put back on bracket. Foreman was pushing on messenger and apparently took hold of bracket with other hand. Bracket was connected to another circuit through a dislodged pulloff.

This work should not have been done on energized wires. Furthermore, the bracket was not covered with rubber, nor rubber gloves used, nor the ground on the bracket discovered by inspection and removed before other work was done.

7-8-29 - Elect. Foreman.

While dismantling transformer and removing copper connections and other parts, this man allowed himself to come in close proximity to 100,000 V. bus which was energized. Arc jumped to his body near left shoulder and went to ground through his body and iron girder in contact with his hips. Sustained shock and serious burns, and fell 24 feet to concrete floor.

This work should not have been done in proximity to energized circuits. Either the circuits should have been de-energized, or barriers erected to prevent a workman from coming within too close a distance from the circuits.

8-3-29 - Lineman.

Apparently came in simultaneous contact with energized 3000 V. feeder and grounded back bone tail piece, lower end of which was in contact with ground. Tail piece had been made up and one end fastended to pole, above feeder, during construction of new work.

Man had been instructed not to go up pole until current was shut off, and the conditions on this pole would have made such precautions particularly necessary. As an additional precaution, however, it is well to coil such wires up off the ground and attach the coil to the pole beyond reach. Additional safety would be provided for persons on the ground who might otherwise come in contact with a wire which was accidentally energized by contact with the other wires.

7-2-30 - Lineman.

Two linemen had been assigned to work clearing overhead wires for B. & B. crew engaged in bridge repair work. One of these men was working on the pole tying energized trolley in clear, and doing so without the use of gloves or other rubber protective appliances. Due to movement without forethought, or accidental movement caused by loss of balance, hand hold, or cutting out of his spurs on the pole, this man allowed his foot to come in contact with wire in use as telephone circuit, which wire had been dropped off its cross arm and to a location four or five feet lower on the pole. This completed the path to ground for the 3000 volt trolley current.

Either the lowering of the telephone wire for an additional two feet, the use of rubber gloves by this lineman, or a piece of rubber hose placed over the telephone wire directly below where this man was working on the pole, would have prevented this accident. The other lineman, who had for years been engaged on what is known as "hot wire" work, and had considerable experience of this nature on our own trolley system, should have been designated by his immediate superior as "lead" lineman, and as such should have assumed the responsibility of keeping close watch over the movements of the man who was doing the work on the pole. In this particular instance he should have cautioned the latter about the possible danger of the position in which he had placed himself.

7-24-30 - Lineman.

While working on tower of gas-electric maintenance car and engaged in repairing broken feeder pin on wood crossarm mounted on cedar pole, lineman, in attempting with his right hand to hook snatch block to loop of span wire, for the purpose of picking up the strain in the feeder wire, and standing between signal wire which was protected by a rubber blanket, and feeder wire left

are due to the difficulty involved in covering on account of presence of feed tap attachment, inadvertently placed his left hand on the back side of the trolley pole to which was attached, in a vertical position, negative dead-end strand, at the same time allowing his knee to come in contact with the 3000 volt feeder wire near which he was standing, completing the circuit between the feeder and the negative.

Since the time of this accident a method has been developed to improve the arrangement of the negative from a safety standpoint and this arrangement has already, at a very considerable cost to the Railroad Company, been applied to a large number of the poles affected. However, the man who lost his life in this accident, and who had assisted in the construction of the trolley system, along with the Foreman and the other two linemen working with him, were all thoroughly experienced in this particular class of work and were familiar with the particular arrangement of the wires on this pole and with the inherent danger. A lack of caution on the part of both the foreman and the men under him in failing to remind this lineman of the existing danger, and to keep close watch over his movements to see that he did not allow himself to come in contact with both the positive and negative wires at the same time, and movement without forethought on the part of the lineman who was actually performing the work, was largely responsible for this accident. Also, had this lineman been wearing rubber gloves at this time, the accident would not have occurred.

10-10-1930 - Locomotive Engineer.

This engineer and a brakeman were on top of the train tying up a broken pulloff which had been struck by the pantograph. The engineer made a loop in the end of a rope and threwthis over the pulloff. He then jerked on the rope to tighten the loop, and in doing so, pulled the pulloff toward him so that it struck his left hand. He received an electric shock which caused him to fall to the roof of the car, and caused burns on his left hand and on soles of his feet. Artificial resuscitation was tried but failed to be effective.

When accidents to wires or equipment happen which require working on or in the vicinity of the trolley circuits, the train dispatcher or load dispatcher should be notified and the wires de-energized. If, on account of the degree of emergency, this is not possible, the work must be done in such a manner that there is no possibility of accidental contact with the wires.

11-14-32 - Lineman.

While sitting on lower beam of one of the steel bridges that carries the trolley and feeder along Walla Walla Avenue in Renton, one foot came in contact with the trolley wire, resulting in electrocution.

This man placed himself in a position in which he was within reaching distance of both the grounded structure and an energized circuit without providing adequate protection.

Under the linemen's safety rules, work under these conditions must be done with the lines deenergized and grounded.

9-21-37 - Electrician.

An electric locomotive with one pantograph up and one down was standing at the terminal roundhouse to be serviced. This electrician climbed to the roof of the locomotive and apparently did not observe that one pantograph was up and came in contact with the other one which was energized with 3000 volts through the bus circuit. He received a severe electrical shock, fell to the ground and suffered a fractured skull. Artificial resuscitation revived him, but the injuries received in the fall resulted in his death a few hours later.

Locomotive instruction books contain the rule that before anyone goes on the roof of an electric locomotive under the trolley wire, pantographs and trolley pole shall be lowered away from the wire, grounded and locked down. The pantograph operating handle must be kept in the possession of the one going on the roof.

8-16-44 - Electrician's Helper.

An electrician and helper, at a terminal, had been on top of a passenger locomotive and had completed their work there and gone into the cab. The electrician had the helper start the auxiliary air compressor in order to secure air pressure for raising a pantograph and when this was done the electrician sounded the bell as a warning and raised the pantograph. It was found that the helper had started back to the roof of the locomotive and contacted the pantograph. The man was removed from the roof and resuscitation attempted, but unsuccessfully. The reason for the helper returning to the roof of the locomotive was never determined.

The man had climbed to the roof of the locomotive without authority, without notice of his intent to do so, and without the protective provisions, such as carrying the pantograph handle, required by operating rules.

The rules covering work on the roofs of locomotives should be followed to the letter and supervisors make sure that workmen are thoroughly instructed on safety rules and discipline applied to enforce the rules.

11-25-50 - Pipefitter.

A locomotive was being made ready for service and a pipefitter, among

others, had been working on the locomotive correcting minor defects. The pipefitter had been informed of an air leak through the auxiliary whistle, and told to inspect and adjust the air valves inside the locomotive which appeared not to be closing properly. Some time after this work was presumed to be done the locomotive was placed under energized trolley, and after conditions on the roof were checked, and the usual whistle warning signal given, one pantograph was raised. When this was done a man's body was seen to fall from the roof and it was found that the pipefitter had been on the roof and in contact with the other pantograph. Prone pressure resuscitation was attempted, but without success.

The reason for the pipefitter being on the roof is unknown. According to established rules, the man should not have been on the roof of a locomotive while under an energized wire unless both pantographs had been lowered and the pantograph handle was in his possession.

Seattle, Wash.
April 2, 1951.

viaduct where the trolley wire is 17' 3" above the rail. The fireman was going on top of the tender and when nearly up the ladder his head struck the trolley wire and the shock caused him to fall into the engine cab. There were no permanent effects from the shock but there was a slight burn on his head. There were danger signs advising of low clearance at this point, which should have been heeded. It was found that the lamps which were supposed to illuminate these low clearance signs were not burning properly, but the fireman should have been aware of the low clearance, nevertheless, and should not have gone on the tender when the locomotive was standing under low wire.

8-5-41 - Non-employe - laborer.

This man was employed by a contractor in icing refrigerator cars at Kent. He was using an icing tool with a metal handle about six feet long which contacted the trolley wire over the car. He received an electric shock and fell from the car and sustained a fractured hip. This accident would have been avoided by the use of a wooden handled tool as is specified for this class of work.

7-11-41 - Substation Operator.

Suffered shock and burns while attempting to adjust the 100,000 volt lightning arrester gap parts on substation roof without first de-energizing the line. Burns on left hand and arm and left foot. Flash possibly occurred from surge on line or lightning. Rules violated by not de-energizing line before doing this work.

11-4-41 - Locomotive Engineer.

Attempted to lubricate pantograph shoe when trolley pole was in contact with trolley wire. Received shock and fell from roof of locomotive to ground, landing on his head and shoulder. Instantly regained consciousness and was able to walk. Dislocated left elbow. Longitudinal crack in left wrist.

Since the trolley pole when up is connected to the circuit to the pantograph, the pantograph was energized. Rules require that the trolley pole and the pantograph be lowered and grounded before going on the roof of the locomotive.

4-28-42 - Trolley Foreman.

There had been a derailment and a bracket arm was being installed and repairs were being made to trolley wire. A coil of 1/4" wire being used on the tower platform got loose while one end was in contact with the trolley wire, and the other end grounded on the side of the tower car near the foreman.

The arc slightly burned the side of his face and neck. The burns were slight and no medical attention was necessary. The accident was caused by carelessness in handling the wire on the tower platform while working on live wires.

5-6-42 - Electrical Inspector.

This man was inspecting an electric locomotive at Tacoma roundhouse. He opened the high tension compartment door and attempted to adjust high voltage apparatus when the pantograph was raised. He was badly burned on left hand and elbow and on right knee and left foot. Left hand had to be amputated. Work should not be attempted on high tension apparatus without first lowering and grounding pantographs, and disconnecting the equipment.

10-24-42 - Apprentice Electrician.

The electrician and his helper were inspecting an electric locomotive at a roundhouse. The electrician lowered the pantograph and gave the pantograph handle to the apprentice, who was going onto the roof. He was climbing to the roof and grasped the frame of the pantograph, receiving an electric shock and fell to the ground. He suffered burns on both hands. Since both pantographs were down, it appears that the pantograph was energized by the motor-generator set which had not stopped running after the power was removed. Instruction book rules require that it be certain that the motor-generator set stops running, and the pantographs be lowered and grounded before working on high tension apparatus.

12-4-42 - Non-employe - Helper.

During the relining of the tunnel at East Portal, the contractors were enclosing a lead covered 3000 volt feeder cable with protective boarding. One nail, following the grain in the wood, penetrated sheath of the cable and caused a flash to contact the left hand of the helper, causing burns on all fingers, about three weeks' disability resulting. The cable should have been de-energized while this work was being done.

8-16-43 - Non-Employe.

While working on pole at west switch, Primrose, contacted 4400 volt signal feeder and drop wire connected to PIL circuit. Became unconscious. Was resuscitated by lineman while hanging on pole. Burned both hands. Later small finger on left hand was amputated.

When working in such a position the wires should be de-energized and grounded, or rubber gloves worn and protective insulation placed over the wire in accordance with rules governing the work of linemen.

12-28-43 - Fireknocker.

An electric engine was standing near the roundhouse at Harlowton after dark and this man climbed on the engine to supply it with sand. He apparently overlooked the fact that the pantograph was up on the other end of the locomotive. He came in contact with the pantograph on his end of the locomotive and was knocked to the ground. He suffered burns on right hand and right foot, and injuries from the fall. The right arm and right foot were later amputated.

The pantograph on the engine should have been lowered and grounded and the pantograph handle in the possession of the man going on the roof. All workmen concerned should be thoroughly instructed on the safety rules and discipline applied to enforce these rules.

2-23-44 - Non-employe Lineman.

A contractor was taking down signal feeder wires. Two linemen were pulling the wires over cross arms and coiling them up. Trolley span wires were attached to the same poles as the cross arms and another crew was installing new span wires and was passing a span over the live trolley. This span sagged into the signal wires on which the men mentioned were working and at the same time lay across the energized messenger. The signal wires being worked on were grounded with a chain ground, but this was not sufficient to prevent injury to the men. They were shocked but not rendered unconscious and duffered burns on their hands. Sufficient care by either crew had not been taken in carrying out the work. The span wire should not have been carried across wires other men were working on unless positive measureswere taken to prevent them contacting. A chain ground is not sufficient protection and safety rules do not permit it to be used in place of a copper cable and clamp, properly applied.

9-22-44 - Non-employe Lineman.

This lineman was working on the B.A.& P. line crew on joint trolley construction west of Butte. He reached across the insulator separating the B.A.& P. trolley from the Milwaukee trolley and suffered burns on both hands. Since the Milwaukee trolley is 3000 volts and the B.A. & P. only 2400 volts, there is a voltage between the two systems and safe working methods must be used working in the proximity to the two circuits.

10-18-44 - Civil Engineers.

These men were using a steel tape and a steel faced level rod in getting data for some excavation work. One man was holding the rod upright underneath the transmission wire and also had hold of the steel tape. The

other end of the tape was held by the other man. The rod apparently was brought close enough to the transmission wires to draw an arc through the rod to the earth. The first man had burns on hands, feet, shoulders, and back. The other man suffered shock but was not unconscious.

The rules given in rule book 3170 regarding work in the vicinity of transmission line and in regard to metal rules must be observed, and should be brought to the attention of all employes by their supervisors.

11-13-44 - Non-employe Lineman.

This man, who was working for a contractor doing trolley construction work for the Railroad, was working on top of a tower car. He had hold of a span wire on the live side of an insulator and contacted the grounded side. He suffered burns on right and left hands. The rules regarding working on energized wires, which require a man to be protected by two insulations, were not observed. If they could not be, the work should have been done with the lines deenergized.

10-29-45 - Section Foreman.

This foreman received an electric shock on coming in contact with the lead sheath of a 4400 volt signal primary cable extended above ground under L Street Bridge in Tacoma. He was rendered unconscious by the shock and was taken to the hospital, where he regained consciousness without any severe after effects. There appears to have been a defective insulator in one of the pothead terminals and since the cable was not grounded, there was considerable voltage on the lead sheath. All lead cable sheath in electrified territory should be grounded.

6-11-45 - Lineman.

While making repairs to the trolley wire near Vendome this lineman was putting a tie wire on the feeder cable after replacing a broken feeder insulator. One end of the tie wire came in contact with a bolt supporting the negative wire and an arc resulted, causing flash burns to his eyes. The accident appears due to insufficient recognition of the fact that there were grounded parts within reach of the end of the tie wire.

12-8-45 - Machinist.

This man went on top of an electric locomotive to make adjustments on the bell. A fireman entered the other end of the locomotive and raised the pantograph on that end, energizing the pantograph which was down on the other end of the locomotive. The machinist came in contact with the latter pantograph

received an electric shock, and fell to the ground.

Artificial resuscitation was applied and the man began breathing after several minutes. He received deep burns on both hands and on right arm.

Before pantographs are raised, when engines are standing at shops or other maintenance points, the top of locomotive should be checked to make sure that no one is on the roof. Also the workman should not have been allowed on the roof until the pantographs were locked down and grounded and the pantograph handle should have been in his possession.

3-7-46 - Non-employe.

This man climbed on top of a locomotive when trolley pole was up energizing the pantograph on the roof. He contacted a pantograph, received electric shock and fell to the ground. He was badly burned but recovered from the shock. This man was a trespasser and had no reason for going on top of the locomotive.

4-7-48 - Boilermaker.

This man had dropped the pantograph and turned off the MG control switch and gone up the side of the locomotive to work on the boiler safety valve. He apparently came in contact with a pantograph and was knocked to the ground, sustaining a severe back injury. Only small burns on his fingers were experienced. He should have ascertained that the MG had stopped, and lowered and grounded the pantograph before going on the roof of the locomotive.

9-15-48 - Machinist Helper.

Electrician and helper were working on a damaged pantograph on top of a locomotive near a roundhouse. The helper in handling the pantograph allowed it to touch the energized trolley wire over the locomotive. The pantograph had been grounded but the helper received enough current to suffer burns on both hands although he did not receive enough electric shock to otherwise injure him.

This work should not have been done under energized wire.

11-17-50 -Fireman.

When a three unit locomotive was leaving the terminal yard with a train, the high speed breaker on the circuit would not close when its control was operated. The engineer, aided by the fireman, was attempting to correct the trouble and one side of the insulating case around the breaker was removed as a means of access to the magnet valve and low voltage control circuits. A

short piece of wood was used to reach into the breaker mechanism in order to actuate the control mechanism. Either this wood block or the glove on the fireman's hand contacted some part of the high voltage circuit and started an arc which caused considerable damage to the breaker.

The fireman received some shock but was not rendered unconscious. He suffered burns on hand, arm, and knee.

The covers over this high tension apparatus were marked "Danger, 3000 Volts" and instructions to enginemen state that "Inspection of live high voltage apparatus is prohibited. Compartment covers or other safeguards on high voltage apparatus shall not be removed or replaced while it is energized."

Seattle, Wash.
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