

EXHIBIT 2-P

Docket No. DCA-08-MR009

**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594**

**Metrolink Instructions Governing Installation,
Maintenance, Inspection, and Testing of Signal
Apparatus and Signal Systems
(Excerpts)**

3.0 SWITCHES

3.1 General Switch Instructions

3.1.1 Switch Installation, Adjustment and Protection

- A. **Closely Approaching or Passing Trains.** Employees must not unlock, adjust or operate switches that will in any way affect closely approaching or passing train or engine movements. Non-interlocked switches in main tracks or leading to main tracks must be locked in normal position when not in use.
- B. **Repair, Replace and Adjust.** Switches must be adjusted and maintained in accordance with test instructions. When repair, replacement, or adjustments are made to parts of switch layouts or facing point locking of switches, proper tests must be made *before* the switch is restored to normal service. Ensure that the new insulated rail joints (polarity joints) in the turnout are not staggered more than four feet six inches; turnout joints not meeting this standard must be corrected.
- C. **Switch and Track Connections.** The FRA require that *before* a switch under construction is left unattended, protection must be provided by spiking the switch point and applying a switch point locking clamp, locked with a signal padlock, with an OUT OF SERVICE tag attached. The track installed must also be bonded to the clearance point.

In addition to the FRA requirements mentioned above, a switch circuit controller, connected to the switch point, must be installed. During the time that the switch is under construction, the switch circuit controller may be wired in the track shunt configuration. No train or engine may use the track that is associated with the switch except a train or engine that is engaged in the construction of the switch and associated track.

- D. **New Switch Placed in Revenue Service.** When a new switch or switch point is placed in service in a signaled track, *before* the switch is left unattended, protection shall be provided by a switch circuit controller connected to the switch point and the track bonded to the clearance point. The switch circuit controller must be wired to open and shunt a track or line circuit.

- ##### 3.1.2 When Necessary to Disconnect Switch Stand, Controller, etc.
- The Track Department must be consulted, and be in agreement, before proceeding with any action described in this section. When necessary to disconnect a switch, switch stand, circuit controller, hand operated switch, movable point frog, derails or associated apparatus (hereinafter called "switch") from the operating mechanism,

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**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

3.0 SWITCHES

or disconnect the No. 1 rod, in addition to providing complete protection for trains, the following must be done:

- A. The closed point must be held securely against the stock rail by a spike driven into the tie against the point on the first tie back of the point (headblock ties) and where possible, through the plates, except where a locking clamp is used as provided in the following paragraph.
- B. No movement will be allowed over a switch if either the first or second tie behind the switch point is removed unless the following precautions are taken:
 - 1. The closed switch point must be secured to the stock rail with a switch point locking clamp.
 - 2. The remaining tie is secured with a spike.
 - 3. Maximum train speed permitted over the switch shall be determined jointly by the track and signal department personnel involved.

Note: Under no circumstances will movement be permitted over a switch if both the first and second ties behind the switch point are removed.

- C. If the power-operated switch is in an interlocking or control point, the following must be done:
 - 1. The locking dog or plunger must be secured in the lock if possible.
 - 2. Contact the Dispatcher and have the switch positioned NORMAL. Then the Dispatcher should put a switch block into effect.
 - 3. The power applied to power-operated switches must be cut off and in addition:
 - a. The motor brushes must be raised and so secured that they cannot come in contact with the commutator, or the fuse must be removed from the circuit supplying power to the master controller.
 - 4. Power-operated switches must be kept spiked or otherwise secured until the power is again turned on so that an accidental change in the position of the controlling apparatus, or connections cannot cause the machine to operate the switch points.

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**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

3.0 SWITCHES

- D. When necessary to disconnect a pipe-connected switch, derail or other unit, disconnect the pipe at the crank nearest the unit.

3.1.3 Maintenance of Switch Circuit Controller:

- A. **Kept Tight** - All nuts and bolts on the rail braces, plates, front rods, head rods, point detector rods, lock rod lever stands, and machines shall be kept tight. Ensure cotter pins are properly placed, and that grip or locknuts are in good condition and tight. Ensure devices and bolts do not have any excessive wear.
- B. **Kept Clean** - Controller compartments, junction boxes, tags, and all wiring will be clean, with adequate clearance from all moving parts. Conduit will be fitted properly and be sealed. (*Caution: It is prohibited to use flammable products for cleaning.*)
- C. **Properly Lubricated** - All components will be properly lubricated and oiled.
- D. **Switch Circuit Controller Inspection** - Determine that circuit controller:
- Contacts are clean, silver plated, uniform, and that springs are in place to ensure sufficient wipe and not less than 1/8th inch when fully open.
 - Rollers are not worn, cracked or have flat spots.
 - Linkage and roller pins are not worn or cracked, and are in the proper position and securely fastened.
 - Terminal block is securely mounted to the housing with mounting bolts tight and nut locking devices effective.
 - Shaft, cams and bushings do not have excessive wear and are properly lubricated.
 - Ensure full bearing surface of roller is on cam.
 - Ensure centering device is effective.

Procedure for Testing the Centering Device: Remove the controller rod at the switch lug, and determine that the contacts are opened or shunted.

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**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

3.0 SWITCHES

3.1.4 Inspection of Rods, Plates and Track Material

- A. **Inspect Insulation.** Inspect the insulation in gauge plates, rods and insulated joints; prompt action must be taken to correct any exceptions.
- B. **Sufficient Clearance.** Maintain sufficient clearance between switch ties and rods and also between rods and ballast.
- C. **Work with Track Forces.** Every effort should be made to work with track maintenance forces to eliminate running rail, poor track surface, drainage problems or other conditions that may cause switch failures.

3.2 Power Switches

3.2.1 Tests (Refer to Section 14, Parts 14.3N, 14.3B and 14.3C for test instructions)

- 3.2.1A Switch Obstruction, Rule 236.382
- 3.2.1B Point Detector, Rule 236.103
- 3.2.1C Shunt Fouling Circuit, Rule 236.104

3.2.2 Additional Instructions for Maintenance of Power Switch Machines

- A. **Keep Switch Plates Clean and Lubricated.** Keep the switch plates clean and graphited. Inspect and ensure that switch plates are not cracked or broken and that rails are seated in switch plates.
- B. **Periodically Check Brushes.** Annually check brushes to ensure connections are tight, and also check for proper tension and wear. Ensure that the commutator is clean.
- C. **Monthly Inspection of the "OS" Track Circuit.** At least monthly walk and inspect the "OS" track and check the condition of bootlegs, rail connections, bonds and insulated joints. Correct any defects.
- D. **Friction Clutch and Overload Relay Tests, US&S M-22 and M-23 Low Voltage Switch Machines.** To test and adjust the friction clutch and to determine that proper voltage is delivered to the motor, the machine must operate against an obstruction with the clutch slipping. To prevent the overload relay from opening the circuit, jumper around the pick-up coil of the overload relay.

Operating Voltage Check:

INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

3.0 SWITCHES

Place an obstruction in the open point of the switch and with the local control panel, or by positioning the switch control relay, move the point against the obstruction. When the point reaches the obstruction, the clutch will slip. With the clutch slipping, measure the voltage from X to Y across the armature and A to D across the field windings. The sum of the two should be at least 20 volts to assure proper switch operation.

For 110-volt switch machines and all other machines refer to manufacturers maintenance manuals for instructions.

Clean Clutch – Annually

If the friction clutch cannot be adjusted, as outlined above, disassemble the clutch assembly and clean according to the following instructions: 1) remove the adjusting nut and clutch spring, and slide the clutch housing off the shaft; 2) remove the discs and plates and clean the shaft and inside of the clutch housing by washing with a non-flammable grease solvent; 3) coat rubbing surfaces of packing rings with gear box lubricant; 4) assemble housing to the shaft; and 5) clean lubricant from shaft surface inside the clutch space.

Fabric discs and clutch plates should be thoroughly cleaned in a non-flammable grease solvent to remove any accumulation of lubricant, and then reassembled. It may be necessary to discard and replace old worn fabric discs. It will be noted that a fabric disc goes in the bottom of the housing, and the first metallic disc is one with teeth engaging the shaft.

Overload Relay Operation

With proper voltage and clutch slip current, repeat the obstruction test with the jumper **removed** from around the pick-up coil of the overload relay. Using a stopwatch, measure the time from the moment the clutch begins to slip until the overload relay pickups up, cutting off power to the machine. If tests are repeated, thermal resistors in the overload relay must be allowed to cool off between tests. Overload relays should "blow down" within 4 to 12 seconds at 12 amperes slip current. Time will be lower for slip currents above 12 amperes and will be higher for slip currents below 12 amperes.

Microprocessor Vital Logic Control Circuits

Switch machine control circuits based on microprocessor vital logic designs, instead of relay logic design, do not employ current sensing overload relays to

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**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

3.0 SWITCHES

remove power from the machine when the switch point is prevented by an obstruction from completing its movement. These designs provide a timing circuit that starts timing when power is applied to the switch machine. If the point completes its movement before the preset time interval expires, the timer is reset. However, if the switch machine is still attempting to complete the movement when time expires, power is removed from the machine. Normally this interval is thirty (30) seconds. Refer to the program for the actual setting. The time setting can be changed only by reprogramming the microprocessor.

Test of Preset Time Interval

Place an obstruction in the open point of the switch and using the local control panel cause the point to move against the obstruction. With a stopwatch measure the time from when the point starts to move until the power is removed from the switch machine. Compare with the circuit plan and note any variations of 10% or more on Form SCAX CS236.100 and report results to Signal Supervisor.

- E. Slide Bar Extension.** The slide bar must extend through the lock rod at least one-half (1/2) inch or more on both the normal and reverse positions.
- F. Switch Point Tension.** The switch point must fit against the stock rail with sufficient tension on the switch adjuster (basket) on both the normal and reverse positions.
- G. Lock Rod Notch Faces.** While making inspections, ensure that the lock rod notch faces are square and not shaved. Inspect using a mirror .
- H. Changing or Installing Lock Rods.** When changing or installing lock rods, ensure that the slide bar passes through the small notch of the lock rod first.

3.3 Electric Switch Locks

3.3.1 Tests (Refer to Section 14, Parts 14.3B, 14.3C and 14.3H for test instructions)

- 3.3.1A Switch Circuit Controller, Rule 236.6 and Rule 236.103
- 3.3.1B Shunt Fouling Circuit, Rule 236.104
- 3.3.1C Time Release, Rule 236.109

3.3.2 Additional Instructions for Maintenance of Electric Switch Locks

3.0 SWITCHES

- A. Quick Release.** Electric switch locks with quick release: Test releasing section track circuit monthly with a zero ohm shunt to ensure quick release circuit does not extend beyond the switch point.
- B. GRS Model 10 Switch Lock Wear Check.** Check Model 10 switch locks at least monthly for wear using the following procedure. Refer to Figure 19
- With the electric switch lock in the locked position and the padlock removed:
 - Pull up on the DEPRESS TO APPLY PADLOCK pedal and attempt to remove the handle from the cradle.
 - The DEPRESS TO APPLY PADLOCK pedal pawl should prevent the switch operating lever from being removed from the machine lock by a minimum of 1/8 of an inch while the switch operating lever is driven toward the shimmed side of its opening.
 - If the pedal pawl restraint is less than 1/8 of an inch, the electric lock should be replaced. **Do not** change mechanical parts of a Model 10. The entire unit must be shopped.
 - There should be no more than 1/8 of an inch total clearance between the sides of the switch operating lever and the sides of the switch lock. Add shims if necessary to reduce the clearance to 1/8 of an inch. **Note** The old style Model 10 electric switch lock is not equipped with shims.

3.3.3 Kept Secure

- A.** Electric switch locks and time releases must be kept locked or sealed.

3.3.4 Other Inspections for Electric Switch Locks

- A. Regularly Inspected.** Electric switch locks and hand-operated switch mechanisms must be regularly inspected to ensure that all parts are intact and operating properly.
- B. Edges Square.** Plungers and locking dogs must be full size at the locking end.

**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

3.0 SWITCHES

Corners of plungers and locking dogs and the edges of opening in lock rods must be kept sufficiently square to prevent the switch from locking with a 1/4 inch gauge between the stock rail and the switch point. The small openings in lock rods must not exceed the width of the rectangular locking dog or plunger by more than 3/8 of an inch.

- C. Use of Oil.** The use of oil on latches, segments or trunnions of electric switch is prohibited.
- D. Holes in Lock Rods.** Holes in lock rods shall have square edges (not beveled or battered) and not be more than 1/8 of an inch larger than the round plunger.
- E. Driving Bar.** The driving bar of the switch and lock movement shall move both normal and reverse so that the locking dog will pass through the lock rod 1/2 of an inch or more.
- F. US&S Style SL-20 and SL-21 Switch Locks.** SL-20 and SL-21 locks will be inspected to ensure that the locking plunger is adjusted properly - over travel of the plunger will open contacts. The end of the plunger should extend approximately 1/4 of an inch beyond the edge of the lock rod.

3.3.5 Hand Operated Switches and Derails - Tests (Refer to Section 14, Part 14.3B and 14.3C for test Instructions)

- 3.3.5A Switch Circuit Controller, Rule 236.6 and Rule 236.103.
- 3.3.5B Shunt Fouling Circuit, Rule 236.104.


**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

TABLE OF CONTENTS Section 3 SWITCHES

3.0 Switches

3.1 General Switch Instructions

3.1.1 Switch Installation, Adjustment and Protection

- 3.1.1A Closely Approaching or Passing Trains
- 3.2.1B Repair, Replace and Adjust
- 3.1.1C Switch and Track Construction
- 3.1.1D New Switch Placed in Revenue Service

3.1.2 When Necessary to Disconnect Switch Stand, Controller, etc.

3.1.3 Maintenance of Switch Circuit Controller

- 3.1.3A Kept Tight
- 3.1.3B Kept Clean
- 3.1.3C Properly Lubricated
- 3.1.3D Switch Circuit Controller Inspection

3.1.4 Inspection of Rods, Plates and Track Material

- 3.1.4A Inspect Insulation
- 3.1.4B Sufficient Clearance
- 3.1.4C Work with Track Force

3.2 Power Switches

3.2.1 Tests

- 3.2.1A Switch Obstruction, Rule 236.382
- 3.2.1B Point Detector, Rule 236.103
- 3.2.1C Shunt Fouling Circuit, Rule 236.104

3.2.2 Additional Instructions for Maintenance of Power Switch Machines

- 3.2.2A Keep Switch Plates Clean and Lubricated
- 3.2.2B Periodically Check Brushes
- 3.2.2C Monthly Inspection of the "OS" Track
- 3.2.2D Friction Clutch and Overload Relay Tests
- 3.2.2E Slide Bar Extension
- 3.2.2F Switch Point Tension
- 3.2.2G Lock Rod Notch Faces
- 3.2.2H Changing or Installing Lock Rods

3.3 Electric Switch Lock

8.0 SIGNALS

8.1 Signal Tests to be Performed

(Refer to Section 14, Parts 14.3A, 14.3F and 14.3H for test instructions)

8.1.1 Ground Tests, Rule 236.107

8.1.2 Searchlight Signal Mechanisms, 6 months, Rule 236.102b

8.1.3 Time Releases, Rule 236.109

8.2 Instructions, Searchlight Signal Mechanisms 2 Years, Rule 236.102b

(Refer to Section 14, Part 14.3A for test instructions)

8.2.1 US&S Style H-2 and H-5 Mechanisms

8.3 General Maintenance Instructions

8.3.1 Signals Must Not be Falsely Cleared

Signals must not be falsely cleared for the movement of trains.

8.3.2 Lenses Clean

Lenses shall be cleaned once a month and as often as necessary to ensure good aspects.

8.3.3 Ladders, Railings Secure

Ladders, hand railings, and platforms shall be maintained in good condition and fastened securely.

8.3.4 Proper Lamp Bulbs

Only 10-volt, 25 watt, precision filament, railway signal service, lamp bulbs are authorized for trackside signal service. The preferred lamp terminal voltage is **9.5** volts. Voltage at the lamp terminal shall not exceed 9.5 volts nor be less than 9.0 volts. Double filament bulbs must not be used.

Signal Lamp Bulb Replacement

Interval

Constantly lighted

Yearly

Approach lighted

Two years

Establish a staggered bulb replacement schedule to avoid heavy renewals at any one time.

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**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

8.0 SIGNALS

8.3.5 Focusing, Alignment and View of Signals

8.3.5A Prevent Phantom Aspects. Action shall be taken, or signal shields installed as necessary, to prevent phantom aspects from reflected external light sources.

8.3.5B Spread the Light. Deflecting prisms or spread lenses shall be assembled and maintained to spread the light in the proper direction. Where replacements are made, identical lenses or roundels must be used.

8.3.5C Changes in Light Receptacles. In light type signals, changes in the lamp receptacle shall not be made from the original settings except where provision has been made for refocusing.

8.3.5D Obstruction of View. Objects such as material, tools, machinery, etc. must not be placed where they may obstruct the view of signals.

8.3.5E Focus and Adjustment. Signal units shall be focused and adjustment maintained to provide the best possible view of the signal aspect.

8.3.5F Bulb Storage. Do not store signal bulbs in signal light unit.

8.3.6 Maintain Signal in Good Condition

All signals, housings and other associated signal apparatus must be maintained in good condition and kept clean. Number plates must be properly installed and legible. Relays must be properly seated. All doors must fit and work freely. Housings must be water tight and rodent free.

8.3.7 Event Recorder Operation

Verify event recorder operation. Insure monthly that the time and date are correct. Reset if necessary.

8.3.8 Protection from Elements

When it is necessary to have doors of housings open during inclement weather conditions, employees must take precautions to protect the instruments and wiring from the elements. In the event moisture inadvertently enters the instrument housings, instruments and wiring must be wiped dry before leaving the location.

8.3.9 Grounding and Lightning Protection (See Standard Drawing G-200.STD)

**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

8.0 SIGNALS

- A. Grounding and lightning protection systems will be maintained to present standards. All new signal houses to be grounded on each corner with welded ground connections
- B. The following general standards apply to ground rod installation and wiring outside of houses and cases.
 - 1. All ground wires on the outside of houses and cases shall be #6 bare, soft drawn copper.
 - 2. Ground wires shall be buried six (6) to eight (8) inches deep.
 - 3. Welded connections to ground rods is the preferred method. Copper clad ground clamp may be used as a temporary connection.
 - 4. No other ground wires shall be connected to the ground rods. Grounding must be installed per Standard Drawing G-200.STD, Typical Grounding for Signal Location, except data radio ground wires and any other ground wires shown on the circuit plans for the specific location.
 - 5. The top of each ground rod shall protrude up from the ground no more than three (3) inches.
 - 6. Bends in the ground wires shall have a radius of eight (8) inches or more.
 - 7. Ground system resistance shall be maintained with a resistance to ground of preferably less than fifteen (15) ohms when dry. Additional ground rods or ground enhancement material shall be applied as necessary to obtain a 15-ohm ground. In no case may resistance to ground exceed twenty five (25) ohms.
- C. The following general standards apply to ground wiring and surge protection inside houses and cases:
 - 1. All ground wires on the inside of houses and cases between the grounding bolt and arresters, surge protectors, and equipment ground terminals, shall be No. 6 insulated, stranded, case wire. Bondstrand must not be used for ground wires.
 - 2. Ground wires shall be routed as directly as possible between the equipment and the grounding bolt, avoiding sharp bends.
 - 3. Ground terminals on code system chassis, carrier chassis, and code rack arresters shall be combined and connected to the grounding bolt with one ground wire.

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**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

14.3F GROUND TESTS FRA 236.107

Purpose:

To detect any grounded wires or power busses that could compromise the safety and integrity of the signal system.

Typically Performed By:

Signal Maintainer

Records:

Record test results on FORM SCAX CS236, Part 236 Inspections and Tests

Results:

Grounds must be eliminated at once. Any ground that cannot be located must be reported to the Signal Supervisor immediately.

Frequency:

- 236.107 (a) Except as provided in paragraph (b) of this section, a test for grounds on each energy bus furnishing power to circuits, the functioning of which affects the safety of train operation, shall be made when such energy bus is placed in service and shall be made at least once every month thereafter.
- (b) The provisions of this rule shall not apply to track circuit wires, common return wires of grounded common single-break circuits, or alternating current power distribution circuits grounded in the interest of safety.

Precautions:

The employee making the test must have information relative to train movements to ensure that the public, and train traffic will not be endangered or delayed while tests are being made. Also, it must be known that no unsafe conditions are set up by the application of testing equipment.

CAUTION: IN NO CASE SHALL A CURRENT READING BE TAKEN WHEN A TRAIN IS CLOSELY APPROACHING OR PASSING, NOR SHALL ANY METER CONNECTED BETWEEN ENERGY BUSES AND GROUNDS BE LEFT UNATTENDED.

Test Procedure:

1. Description of Test No. 1

Make test by measuring voltage potential between each energy bus and ground. A preliminary test shall be made with a voltmeter and a 22.5-volt test battery in series with one lead to a ground bus and the other lead to a track wire. In the absence of a track wire use a known ground.

14.3F GROUND TESTS FRA 236.107

Results Expected

If a reading is observed on the meter, this will prove the meter is operating and the integrity of the ground circuit. If no meter reading is observed, check the ground rod and connections.

2. Description of Test No. 2

Connect a voltmeter (TS-111 or equivalent) lead with the test battery in series with the ground bus, and proceed with the other lead checking each energy bus, all aerial, and all underground wires on the terminal board(s).

Results Expected

If the voltmeter reads the total battery voltage on any circuit.* Remove the test battery and ensure that the circuit is energized through the normal functioning of the circuit in question.

***Note:** Any deflection of the meter may indicate a grounded circuit. Scale the meter down to verify the presence of a ground. A ground is not present if the meter needle deflection does not significantly increase as the meter is scaled down. Should a voltage ground be detected, switch meter to current scale to verify ground.

CAUTION: Obtain Track and Time authority before taking current readings.

Clear all grounds

Clear grounds from all circuits with a current in excess of 75% of the release value of any relay or electromagnetic device in the circuit.

Grounds below 75% of the release value must be cleared within 72 hours.

Inspect lightning protection for physical damage and replace where needed.

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INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

14.3G INSULATION RESISTANCE TESTS WIRES IN TRUNKING AND CABLES FRA 236.108

Purpose

To insure that the insulation of wires and connected apparatus meets with resistance values presented under **Results**.

Wires connected directly to track rails need not be tested.

Typically Performed By:

Signal Inspector

Records:

Record tests results, and any action, taken on FORM SCAX CS234.267/236.108, Ten Year Insulation Resistance Tests, Wires in Trunking and Cables.

Results:

Wires with insulation resistance below 1 megohm must be reported to the Signal Supervisor who must report this to the District Signal Manager. When insulation resistance of wire or cable is found to be less than the values indicated in the test, prompt action must be taken to repair or replace the defective wire or cable.

No circuit will be permitted to function on a conductor having an insulation resistance to ground or between conductors of less than 200,000 ohms. Immediate corrective action must be taken and clearly shown on record form.

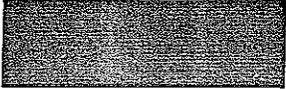
Frequency:

Insulation resistance of wires and cables, except wires connected directly to track rails, shall be tested when wires, cables and insulation are dry. Insulation resistance tests shall be made between all conductors and ground, and between conductors in each multiple conductor cable, and between conductors in Trunking, when wires or cables are installed and at least once every ten years thereafter.

When insulation resistance of wires or cable is found to be less than 500,000 ohms, prompt action shall be taken to repair or replace the defective wire or cable and until such defective wire or cable is replaced, insulation resistance tests shall be made annually.

In no case shall a circuit be permitted to function on a conductor having an insulation resistance to ground or between conductors of less than 200,000 ohms during the period required for repair or replacement.

Precautions:


INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

14.3G INSULATION RESISTANCE TESTS WIRES IN TRUNKING AND CABLES FRA 236.108

The employee making the test must have information relative to train movements to ensure that the public, and train traffic will not be endangered or delayed while tests are being made. Also, it must be known that no unsafe conditions are set up by the application of testing equipment.

Test Procedure:

1. Test must be made with a megger with a self-contained source of direct current test voltage. Megger must read from zero to 20 megohms minimum and be rated at 250 volts minimum, 650 volts maximum.
2. Test megger operation prior to cable testing by insuring that the megger reads infinity when the meter leads are open and zero when the leads are touched together. Insure that the terminal or buss being used as a ground is connected to ground by placing one lead of the megger to a structure ground and placing the other lead to the ground terminal of the buss. When operated, the megger must read zero resistance.
3. Tests shall be made when wires, cables and insulation are dry.
4. Instructions covering the use of jumpers, safeguarding of train movements, and other safety precautions, must be observed.
5. Complete insulation resistance tests include, in the case of wires and single conductor cables, measurement of insulation resistance from each conductor to ground. In the case of multiple conductor cables, measure insulation resistance from each conductor to ground, and between each conductor and all other conductors in the cable (cross meggering).
6. Each conductor of a multiple conductor cable shall be opened at both ends when insulation resistance is being measured. When using direct reading instrument as prescribed in paragraph 1 of this test procedure, one conductor shall be opened at both ends and tested for insulation to ground.
7. Prior to placing the conductor in service, have the person at the opposite end of the conductor insure continuity by grounding that end of the wire. Megger must read zero.

14.3H TIMING RELAYS AND TIMING DEVICES FRA 236.109

Purpose

To insure that safety is not compromised due to improper timing delay provided by a timing relay or other time-release device.

Typically Performed By:

Signal Inspector

Records:

Record test results on FORM SCAX CS236, Part 236 Inspections and Tests

Results:

Any relay or device with a time less than 90% of that that shown on the plans shall immediately be adjusted or replaced and action must be taken for the safe protection of trains. Any device or relay with a time 10% higher than shown on the plans or device shall be replaced or adjusted as soon as practicable.

Frequency:

Time releases, timing relays and timing devices shall be tested at least once every twelve months. The timing shall be maintained at not less than 90 percent of the predetermined time interval, which shall be shown on the plans or marked on the time release, timing relay, or timing device.

Precautions:

The employee making the test must have information relative to train movements to ensure that the public, and train traffic will not be endangered or delayed while tests are being made. Also, it must be known that no unsafe conditions are set up by the application of testing equipment.

Inspection Procedure:

1. Insure that the predetermined time interval for each timing device is shown on the circuit plan and marked on the device itself. Be sure the time interval is the same. Enter this time interval under PREDETERMINED TIME on FORM SCAX CS236.
2. Inspect timing devices for damage to internal components, loose parts, burned contacts, etc. Insure that seals are intact and have not been tampered with.

Test Procedures:

14.3H TIMING RELAYS AND TIMING DEVICES FRA 236.109

Timing Relays

1. For electric locks equipped with timing relays:
 - a. Start timing relay and check time to unlock.
2. At controlled signals with approach locking:
 - a. Clear the signal to be tested.
 - b. De-energize the approach relay.
 - c. Restore the signal to stop.
 - d. Measure the time until the Approach Stick Relay (ASR) energizes.
 - e. Observe lock indication lights on the control machine for proper indication before and after expiration of time.
3. At controlled signals with time locking:
 - a. Clear the signal to be tested.
 - b. Restore the signal to stop.
 - c. Measure the time until the Approach Stick Relay (ASR) energizes.
 - d. Observe lock indication lights on the control machine for proper indication before and after expiration of time.
4. For electronic timing relays with LED digital readouts, use an independent timing device to verify the accuracy of the LED readout.

Timing Devices

1. For Loss of Shunt (LOS) timing devices used in loss of shunt protection:

14.3H TIMING RELAYS AND TIMING DEVICES FRA 236.109

- a. De-energize the Track Relay (TR)
- b. Re-energize the track relay.
- c. Measure the time until the repeater controlled by the LOS picks up.
- d. Observe track indication lights on the control machine for proper indication before and after expiration of time.

2. Vital Processor Timers

- a. Activate timer and start measuring time. Monitor the output of the timing device with a meter.
- b. Stop measuring time when the state of the output changes or the lock indication lights display unlock.
- c. Record the time and insure it is not less than, nor 10% more than the time shown on the circuit plans.
- d. Observe lock indication lights on the control machine for proper indication before and after expiration of time.

14.3J TIME LOCKING TEST FRA 236.378

Purpose

Locking that insures, that after a signal has been caused to display an aspect to proceed, prevents, until after the expiration of a predetermined time interval after such signal has been caused to display its most restrictive aspect, the operation of any interlocked or electrically locked switch, movable-point frog, or derail in the route governed by that signal, and which prevents an aspect to proceed from being displayed for any conflicting route.

Typically Performed By:

Signal Inspector with Signal Maintainer

Records:

Record test results on FORM SCAX CS236, Part 236 Inspections and Tests

Results:

If any discrepancies are found during testing, immediately notify the Signal Supervisor and arrangements are to be made for the safe protection of trains.

Frequency:

Time locking shall be tested when placed in service and thereafter when modified, disarranged, or at least once every two years, whichever shall occur first.

Precautions:

The employee making the test must have information relative to train movements to ensure that the public, and train traffic will not be endangered or delayed while tests are being made. Also, it must be known that no unsafe conditions are set up by the application of testing equipment.

Test Procedure:

All Systems:

Each route's effective time element device must run the entire predetermined time interval at least once during this testing procedure, ensuring that the release is effective.

CTC Control Points and Interlockings

Time locking must be tested as follows:

1. Clear each home signal.

14.3J TIME LOCKING TEST FRA 236.378

2. Restore the signal to the stop position and verify that the time element relay, or device acting as a timing relay, is operating and that the appropriate signal lock relay is de-energized, or proper logic state is in effect.
3. Determine that the route cannot be changed, and that no signal will display an aspect to proceed over a conflicting route at the location under test while the timing device is operating. Additionally, verify that no aspect control information is sent toward an adjacent control point that would permit any conflicting signal to display an aspect to proceed.

Hand Operated Switches Equipped With Electric Locks Where Time Locking is Effective:

Time locking must be tested as follows:

1. If the electric lock is equipped with a releasing track circuit, simulate a train occupancy and determine that the electric lock will unlock.
2. Restore the location to normal and place a hard wire (zero ohm) shunt at the switch points and determine that the release will not operate. Ensure that the lock will not unlock and that the time element relay, or device acting as a timing relay, is operating.
3. After the predetermined time interval has expired, determine that the electric lock can be unlocked.

At all Hand Operated Switches Equipped with a Leaving Signal in Lieu of an Electric Lock

Where Time Locking is Effective:

1. Determine the manner in which the leaving signal used in lieu of an electric lock is time locked.
2. Reverse the switch and determine that leaving signal used in lieu of an electric lock does not clear, and that the time element relay, or device acting as a timing relay, operates.
3. After the predetermined time interval has expired, determine that the leaving signal clears.


INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

14.3K ROUTE LOCKING TEST FRA 236.379

Purpose

To insure that the route remains locked in advance of a train that has accepted a signal to proceed into that route, and that all switches remain locked under the train. This test is to confirm that route locking functions as intended.

Typically Performed By:

Signal Inspector with Signal Maintainer

Records:

Record test results on FORM SCAX CS236, Part 236 Inspections and Tests

Results:

If any discrepancies are found during testing, immediately notify the Signal Supervisor and arrangements are to be made for the safe protection of trains.

Frequency:

Route locking or other type of switch locking shall be tested when placed in service and thereafter when modified, disarranged, or at least once every two years, whichever shall occur first.

Precautions:

The employee making the test must have information relative to train movements to ensure that the public, and train traffic will not be endangered or delayed while tests are being made. Also, it must be known that no unsafe conditions are set up by the application of testing equipment.

Test Procedure:

Route locking must be tested by clearing each signal individually that governs movement over a route. Proceed as follows:

1. Line the route to be tested.
2. Clear a home signal for the route to be tested.
3. Shunt the first track circuit beyond the signal.
4. Determine that power operated switches, movable point frogs or derails cannot be operated within the shunted track circuit or any part of the route remaining ahead of the shunted track circuit.
5. Shunt each succeeding track circuit individually in the route to simulate a train moving through the route lined and repeat test 4. These tests are to be repeated until all track circuits in the route have been shunted in the proper sequence.

[REDACTED]

INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

14.3K ROUTE LOCKING TEST FRA 236.379

6. During this route locking test, ensure that two (2) track circuit restoring is effective by observing the ASR operation. The ASR should not pick up until two consecutive track circuits beyond the signal are occupied simultaneously. Where a special ASR restoration circuit is provided, refer to the circuit plan and verify that the circuit is functioning as intended.
7. Repeat for each route in the plant.

Note: In lieu of shunting each track circuit, track repeaters may be opened to perform this test provided that the integrity of each track repeater in the interlocking is tested by shunting each individual track circuit and observing that its corresponding track repeater is opened. Also insure that the track repeater is used in the route locking circuit and not the track relay. If the track relay is used then the track circuit will have to be shunted or the track relay opened.

[REDACTED]

INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

14.31 APPROACH LOCKING TEST FRA 236.377

Purpose

Approach Locking insures that while a train is approaching a cleared signal, the route cannot be changed or opposing signal cleared until after the signal is set to its most restrictive aspect and a predetermined amount of time has expired. This test is to confirm approach locking functions as intended.

Typically Performed By:

Signal Inspector with Signal Maintainer

Records:

Record test results on FORM SCAX CS236, Part 236 Inspections and Tests

Results:

If any discrepancies are found during testing, immediately notify the Signal Supervisor and arrangements are to be made for the safe protection of trains.

Frequency:

Approach locking shall be tested when placed in service and thereafter when modified, disarranged, or at least once every two years, whichever shall occur first.

Precautions:

The employee making the test must have information relative to train movements to ensure that the public, and train traffic will not be endangered or delayed while tests are being made. Also, it must be known that no unsafe conditions are set up by the application of testing equipment.

Test Procedure:

At All-Relay Interlockings, Control Points, and in CTC Territory:

1. Determine that each track circuit within the limits of the approach circuit will de-energize the approach relay.
2. Clear each home signal individually.
3. Disable the time element relay.
4. Open the respective approach relay.
5. Determine that the route cannot be changed for a conflicting route, and that no conflicting signal will display an aspect to proceed.
6. Reclear the original home signal.
7. Enable the time element relay.
8. Restore the signal to the stop position and verify that the time element relay is operating. With the approach unoccupied and approach relay energized be sure time

[REDACTED]

**INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS**

14.3I APPROACH LOCKING TEST FRA 236.377

element relay does not run. If approach relay is de-energized, time element relay should run when signal is put to stop.

9. Determine that the route cannot be changed and that no signal will display an aspect to proceed for a conflicting route while the time element relay is operating.
10. This test must be repeated for all possible routes.

At All Hand Operated Switches Equipped with Electric Locks Where Approach Locking is Effective:

1. Determine the manner in which the electric lock is approached locked.
2. Without a signal request over the territory containing the electric lock and the approaches unoccupied (as determined in 1 above) determine the electric lock can be unlocked.
3. With a signal cleared, or the approach occupied (as determined in 1 above), determine the electric lock cannot be unlocked until time has expired at the electric lock.
4. Repeat step 3 by clearing an opposing signal and/or opposing approach occupied.
5. Ensure by steps 3 and 4 that each approach is tested individually and are individually effective.

At All Hand Operated Switches Equipped with a Leaving Signal in Lieu of an Electric Lock:

1. Determine the manner in which the leaving signal used in lieu of the electric lock is approached locked.
2. Line the switch reverse, without a signal request over the territory containing the location under test and the approaches unoccupied (as determined in 1 above) determine that leaving signal in lieu of the electric lock clears.
3. With a signal cleared, or approach (as determined in 1 above) to the location under test occupied, line the switch reverse and determine that the leaving signal that is used in lieu of the electric lock does not clear.
4. Repeat step 3 by clearing an opposing signal and/or approach occupied.
5. Ensure by steps 3 and 4 that each approach is tested individually and are individually effective.

[REDACTED]

INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

14.3N SWITCH OBSTRUCTION TEST FRA 236.382

Purpose

Test is to insure that when switch points including moveable point frogs are fully closed, they will be prevented from opening more than 1/4 inch by lock rods and switch cannot be locked normal or reverse if opening exceeds 1/4 inch.

Typically Performed By:

Signal Maintainer

Records:

Record test results on FORM SCAX CS236, Part 236 Inspections and Tests

Results:

If any discrepancies are found during testing, the signal maintainer shall immediately make the proper adjustments to insure the switch passes the test. Locking edges of lock rods must be square. The small openings in lock rods must not exceed the width of the rectangular locking dog or plunger by more than 3/8 inch. Any lock rod not meeting these criteria shall be immediately replaced. If repairs or adjustments cannot be made immediately, the Signal Supervisor must be informed and arrangements made for the safe protection of trains.

Frequency:

Switch obstruction test of lock rod of each power-operated switch and lock rod of each hand-operated switch equipped with switch-and-lock-movement shall be made when lock rod is placed in service or changed out, but not less than once each month.

Precautions:

The employee making the test must have information relative to train movements to ensure that the public, and train traffic will not be endangered or delayed while tests are being made. Also, it must be known that no unsafe conditions are set up by the application of testing equipment.

Inspection and Test Procedure:

Inspection Procedure:

1. Inspect the general condition of switch layout that may affect reliability and safety, such as surfacing, ties, braces, rods, points, stock rails, nuts, bolts and cotter pins.
2. Inspect general condition of power-operated switch machine which may affect reliability and safety including:

[REDACTED]

INSTRUCTIONS GOVERNING INSTALLATION,
MAINTENANCE, INSPECTION AND TESTING OF SIGNAL APPARATUS AND SIGNAL SYSTEMS

14.3N SWITCH OBSTRUCTION TEST FRA 236.382

- a. Check for play and lost motion in switch operation due to worn pins, worn head timbers, defective or worn cranks, loose rods, etc.
 - b. Check that hand-operated switches operate properly.
 - c. Insure that the slide plates are adequately lubricated.
3. Check the position of the points to insure they lay flush against the stock rail.

Test Procedure:

1. Place a 1/4-inch obstruction between the open point and the stock rail, 6 inches from the end of the point.
2. Operate the switch machine against the obstruction.
3. Insure that the switch machine does not lock and fails to indicate. If switch does lock, lock rods must be immediately adjusted.
4. Remove obstruction and repeat for all points in switch, both normal and reverse.