

DCA-08-MR-009  
Metrolink – UP Collision  
Chatsworth, CA  
September 12, 2008

## ATTACHMENT 13

Metrolink Instructions Governing  
Installation, Maintenance, Inspection and  
Testing of Signal Apparatus and Signal  
Systems – Excerpts



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

**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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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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- 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 1/8<sup>th</sup> 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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**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:



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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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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**



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- 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.



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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.



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**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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**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)**



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**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.