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Agency / Organization

CONRAIL

Title

Conrail Instructions for Making Tests of Signal Aparatus

Rev. 1-03

CONRAIL

INSTRUCTIONS

FOR MAKING TESTS OF

SIGNAL APPARATUS

C&S 27

INSTRUCTIONS FOR MAKING TESTS OF SIGNAL APPARATUS

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INSTRUCTIONS FOR MAKING TESTS OF SIGNAL APPARATUS

GENERAL

Tests outlined below will be performed by qualified employees and must be made periodically as specified and more frequently or with more stringent requirements when conditions warrant. Additional tests, when required, must be made in accordance with instructions in connection therewith.

Employees performing test must record all tests on required test forms. Signature on test form indicates compliance with test. Reports are to be forwarded to the appropriate supervising employee no later than the 5th of the next month who will keep a running record of periodic tests as they are performed. The record of periodic test form must be distributed to the designated supervision no later than the 15th of the month following the last month of each calendar quarter.

The normal functioning of any device shall not be interfered with in testing or otherwise without first taking measures for safety of train operation which depends on normal functioning of such device.

When making electrical tests of switch and signal circuits, the proper meters must be used and no unsafe conditions must be set up by the application of such testing apparatus.

When switch, signal or other circuits are used for temporary telephones, it must be determined that such use will not affect the circuits.

When apparatus, the proper functioning of which is essential to the safety of train operation, fails to perform its intended signaling function, it shall be adjusted, repaired or replaced without undue delay.

TEST 1 - 382 SWITCH OBSTRUCTION

(Rev. 6-10)

Test is to ensure proper maintenance and adjustment of switches. Test shall be made in accordance with instructions in the C&S 23, 400 SECTION.

At Least Once Every Month

Obstruction Test

After obstruction has been inserted, attempt to lock switch when equipped with lock rods. When not equipped with lock rods in signal territory or yards, assure that signal circuit is open or track circuit is open and/or shunted by circuit controller with a meter.

1. Interlocked switches (1/4inch obstruction).
2. Non-interlocked switches with circuit controllers (1/4inch obstruction).
3. Yard switches (3/8inch obstruction).
4. Lift type derails (1/2inch obstruction)

Record results of test on form C&S 382

TEST 2-103 SWITCH CIRCUIT CONTROLLERS AND/OR POINT DETECTORS

(Rev. 6-10)

Test is to ensure that switch circuit controllers and point detectors are in good condition and are properly adjusted.

Circuit controllers and their connections shall be securely fastened in place.

At Least Once Every Three Months

Where normally open contacts are used to shunt the track circuit for switch protection, care must be taken to assure that each contact is independently adjusted to shunt the track when point is obstructed from closing 1/4 inch or more.

A. Hand Operated Switches with Circuit Controllers with Normally Open Contacts.

1. Visually check that contacts are not contaminated, burned, grooved or worn excessively and rollers move freely and have no flat spots.

2. Place 1/4 inch obstruction 6 in. from point, between switch point and stock rail and prevent other contacts in multiple from closing by insertion of insulating material between contacts.

3. A voltmeter placed across contact being checked will read track circuit voltage when contact is open and zero voltage when contact is closed.

4. Repeat procedure for other contacts.

5. Make sure insulating material has been removed from all contacts when test has been completed.

6. Apply moderate force with a lining bar between the stock rail and closed point. Verify contacts do not close in either the normal or reverse position.

Note: Apply only enough force as necessary without risk of injury.

Record results of test on form C&S 103

B. Hand Operated Switches with Circuit Controller with Normally Closed Contacts. Contacts shall be maintained with an opening of not less than 1/16 inch when open.

1. Visually check that contacts are not contaminated, burned, grooved, or worn

2. Cross connect a voltmeter from the relay side of the contact being tested to the battery side of the other double break contact in the circuit, assuring that voltage reading is obtained.

3. Operate the switch to its full opposite position and ascertain loss of voltage by using a meter.

4. Place 1/4 inch obstruction 6 in. from point between switch point and stock rail, operate switch against 1/4 inch obstruction and see that the meter indicates no voltage. Lock rods must be floated where mechanical locking is provided.

5. Place 1/8 inch obstruction six inches from point; operate switch against 1/8 inch obstruction, assuring that voltage reading is obtained.

6. Remove obstruction and make certain a voltage reading is obtained.

7. Connect a voltmeter across the contacts on the relay side of the circuit and make certain a voltage is obtained.

8. Operate switch to mid-point and ensure no voltage on meter.

9. Repeat procedure for each contact for each position of switch.

10. Apply moderate force with a lining bar between the stock rail and closed point. Verify contacts do not open in either the normal or reverse position.

Note: Apply only enough force as necessary without risk of injury.

Record results of test on form C&S 103

C. Point Detector - Test is to ensure that point detector is maintained so that contacts cannot be opened by applying force and are properly adjusted. Applies to power operated switches in both interlocking and traffic control systems.

GRS Model 5 Point Detector - Long / Short Detector Rods

1. Crank open switch point associated with long point detector rod.

2. Place 1/4 inch obstruction 6 inches from point between switch point and stock rail and float lock rod.

3. Crank switch machine to close switch points and lock switch.

4. Visually insure contacts are open 1/16 inch and verify opening by means of a meter.

5. Crank switch point open and remove 1/4 inch obstruction.

6. Crank switch points closed and confirm point-detector contacts are made (closed).

7. Repeat procedure for the short detector rod.

8. If a failure of either the long or short detector rod is detected, readjust the switch machine in accordance with the C&S 23, 400 Section.

9. C&S 27 Test 1-382, switch obstruction, is to be made at this time.

10. Apply moderate force with a lining bar between the stock rail and the closed point. Verify contacts do not open in either normal or reverse position.
Note: Apply only enough force as necessary without risk of injury.

Record results of test on form C&S 103

Lift type derails connected to GRS Model 5 power operated switch machines will be tested as follows:

1. Place obstruction on top of rail to stop derail ½ inch from its normal position and ensure switch machine does not lock and does not indicate.

2. Place obstruction such that it prevents derail from assuming the full non-derailing position and ensure switch machine does not lock and does not indicate.

3. Ensure switch machine locks and indicates properly when derail is in its full derailing position and its full non-derailing position.

Record results of test on form C&S 103

ALSTOM GM4000A POINT DETECTOR with EFFECTIVE LATCH OUT FEATURE

1. Operate switch machine to mid-stroke. Position 3/8-inch end of the spoon gauge (Alstom Model No: GMA50-002-00) between the roller and the point detector rod shoulder, ensure gauge is snug.

2. Operate switch to close and lock the switch point. Verify switch is latched out and does not indicate by means of a meter.

3. Insure latch cannot be reset.

4. Remove point detector gauge and verify switch does not indicate until latch is reset.

5. Repeat test for switch point associated with point detector sleeve.

6. If a failure of either the point detector rod or point detector rod sleeve is detected, readjust the switch machine in accordance with the Alstom GM4000A Switch Machine manual.

7. C&S 27 Test 1-382, switch obstruction, is to be made at this time.

8. Apply moderate force with a lining bar between the stock rail and the closed point. Verify switch indicates in either normal or reverse position.

Note: Apply only enough force as necessary without risk of injury.

Record results of test on form C&S 103

ALSTOM GM4000A POINT DETECTOR without EFFECTIVE LATCH OUT FEATURE

1. Operate switch machine to mid-stroke. Place 1/4-inch obstruction 6 inches from switch point between point associated with point detector rod and stock rail and float lock rod.

2. Operate switch to close and lock the switch point. Verify switch does not indicate by means of a meter.

3. Open switch point and remove 1/4 –inch obstruction.

4. Close switch point and verify switch does indicate.

5. Repeat test for switch point associated with the point detector sleeve.

6. If a failure of either the point detector rod or point detector rod sleeve is detected, readjust the switch machine in accordance with the Alstom GM4000A Switch Machine manual.

7. C&S 27 Test 1-382, switch obstruction, is to be made at this time.

8. Apply moderate force with a lining bar between the stock rail and the closed point. Verify switch indicates in either normal or reverse position.

Note: Apply only enough force as necessary without risk of injury.

Record results of test on form C&S 103

US&S Point Detector with Latch Out feature:

1. With switch in full reverse position place point detector gage (PC 295326 for M-3 & M-23 switch machines) between the roller and the point detector bar shoulder, ensure gage is snug.

2. Visually insure contacts are open 1/16 inch and verify opening by means of a meter.

3. Insure latch cannot be reset.

4. Remove point detector gage and verify contacts remain open until latch is reset.

5. Repeat test with switch in full normal position.

6. If a failure of either the point detector rod or point detector rod sleeve is detected, readjust the switch machine in accordance with the C&S 23, 400 Section.

7. C&S 27 Test 1-382, switch obstruction, is to be made at this time.

8. Apply moderate force with a lining bar between the stock rail and the closed point. Verify contacts do not open in either normal or reverse position.

Note: Apply only enough force as necessary without risk of injury.

Record results of test on form C&S 103

US&S Point Detector without Latch Out feature:

1. Open switch point associated with point detector rod.

2. Place 1/4 inch obstruction 6 inches from switch point between point and stock rail and float lock rod.

3. Close switch points and lock switch, insuring slide bar is fully driven.

4. Visually insure contacts are open 1/16 inch and verify opening by means of a meter.

5. Open switch point and remove 1/4 inch obstruction.

6. Close switch point and confirm point-detector contacts are made (closed).

7. Repeat procedure for the switch point associated with the point detector sleeve.

8. If a failure of either the point detector rod or point detector rod sleeve is detected, readjust the switch machine in accordance with the C&S 23, 400 Section.

9. C&S 27 Test 1-382, switch obstruction, is to be made at this time.

10. Apply moderate force with a lining bar between the stock rail and the closed point. Verify contacts do not open in either normal or reverse position.

Note: Apply only enough force as necessary without risk of injury.

Record results of test on form C&S 103

D. Other Circuit Controllers and Point Detectors

1. Hand operated crossover switches, equipped with circuit controllers shall be so adjusted that the control circuits for both tracks will be open or shunted, or both, when the points of either switch or the points of both switches simultaneously are open 1/4 inch or more with the gauge placed 6 inches from the point. Test shall be made to assure that the control circuits are open:

    A. Placing a 1/4 inch obstruction 6 inches from the point of the A end, with B end in full normal position and verifying that the control circuits are open.
    B. Operate the A end to full reverse position, with the B end normal and verifying that the control circuits are open.
    C. Placing a 1/4 inch obstruction 6 inches from the point of the B end, with A end in full normal position and verifying that the control circuits are open.
    D. Operate the B end to full reverse position, with A end normal and verifying control circuits are open.
    E. Operate both A and B ends to full reverse position and verifying that the control circuits are open.

2. Hand Operated Switches with Point Detector and latch out feature shall be adjusted to ensure latch out is effective when using appropriate point detector gage. Visually insure contacts are open 1/16 inch and verify opening by means of a meter.

3. In signaled territory switch circuit controllers provided with circuitry to interrupt operation of Automatic High-Way Crossing Warning Devices shall be tested in accordance with part B and further adjusted to assure that when reverse point is with in 1/4 inch of Reverse point stock rail; interruption of Automatic High-Way Crossing Warning Devices is effective.

    (In Non-Signaled territory Test 22-234 Part B-17 will govern.)

4. Circuit controllers connected at mid-point of 45' switch points should function (proper indication contacts closed) with obstruction of 1/2 inch between point and stock rail.

5. Circuit controllers connected to hand operated lift type derails shall be so adjusted that the control circuits will be opened or shunted, or both, or the track will be shunted when derail is moved 1/2 inch or more from its normal derailing position, measured in horizontal direction.
    A. Placing a 1/4 inch obstruction 6 inches from the point of switch with derail normal and verifying that the control circuits are open.
    B. Operate the switch to full reverse position with derail normal and verifying that the control circuits are open.
    C. Moving the derail 1/2 inch from its normal derailing position with the switch normal and verifying that the control circuits are open.
    D. Operate derail to full reverse position with the switch normal and verifying that the control circuits are open.
    E. Operate both switch and derail to their full reverse position and verifying that the control circuits are open.

6. Circuit controllers connected to hand operated single point derail shall be so adjusted that the control circuits will be opened or shunted, or both, or the track will be shunted when the derail point is within 2 1/2 inches of the stock rail.
    A. Placing a 1/4 inch obstruction 6 inches from the point of the switch, with the derail normal and verifying that the control circuits are open.
    B. Operate the switch to full reverse position with the derail normal and verifying that the control circuits are open.
    C. Moving the derail 1/2 inch from its normal derailing position with the switch normal and verifying the control circuits are open.
    D. Operate the derail to full reverse position with the switch normal and verifying that the control circuits are open.
    E. Operate both switch and derail to their full reverse position and verifying that the control circuits are open.

Record results of test on form C&S 103

TEST 3-104 FOULING CIRCUITS AND TRACK SHUNT WIRES ON SWITCHES

(Rev. 6-10)

Inspection is to ensure that fouling wires (at least two conductors) provide good electrical connection between main rails of a track circuit and sections of rail blocked by insulating joints in turnouts, crossovers, etc.

Inspect At Least Once Every Month

A. Make thorough inspection and apply BLAZE ORANGE PAINT as needed on all fouling and shunt wires on interlocked and hand operated turnouts and crossovers per Standard Plan CS-400. Inspect and apply YELLOW PAINT as needed at clearance points.

Record results of inspection on form C&S 382.

Test At Least Once Every Three Months

B. Test fouling wires by connecting a voltmeter across main track rails and observe that there is loss of main track voltage when individual track shunts are placed at each side of the insulated joints of the turnout and at each clearance point of the fouling circuits.

Test track shunt wires by connecting voltmeter across main track rails and operate switch or center lever checking meter for loss of voltage sufficient to de-energize main track relay.

Record Results of Test on Form C&S 103

TEST 4-107 GROUND TESTS

(Rev. 1-03)

This test shall be made at each buss supplying power to all circuits. This test is not required on track circuit wires, A.C. distribution circuits grounded in the interest of safety, or detector locations where the battery buss is intentionally grounded.

Test shall be made by measuring the voltage between each energy buss and ground, if voltage reading is obtained, current reading shall be taken to determine whether the ground is in excess of 0.025 ampere on a high voltage battery or 0.001 ampere on a low volt battery, up to and including 50 volts.

If excess current is detected further tests shall be made to determine the cause and such cause corrected immediately. If location has power off relay, test is to be made with A.C. power on and off, and with lights operating. If no voltage reading is obtained check for main ground by connecting voltmeter between ground and track rail. Meter should indicate deflection on low volt scale.

Highway Grade Crossing Warning Devices test for grounds in accordance with Test 22-234.

At Least Once Every Month

A. Take readings at interlocking and control points.

At Least Every Three Months

B. Take readings at locations other than those listed in A.

When Required

C. Take readings at all locations when placed in service.

Record results of test on form C&S 107

TEST 6-102 SEARCHLIGHT MECHANISMS AND COLORLIGHT SIGNALS

(Rev. 1-03)

Inspection and test is to insure that signal mechanisms are functioning as intended, and are free from friction or other interference, which might prevent proper operation.

Colorlight and Searchlight signal inspection is to verify compliance with Conrail's standard for lens and hood configuration and to check for water leakage.

At Least Once Every Six Months

A. Searchlight Signal

1. Disconnect cable from positive post only
2. Connect red lead of testset box to positive (+) post and black lead to negative (-) post.
3. Observe the mechanism for excess friction as it moves from red to yellow, yellow to red, red to green and green to red in response to application and removal of normal and reverse energy from the test box.

Record results of test on form C&S 102

B. Colorlight and Searchlight Signals Inspection

1. Inspect all Colorlight and Searchlight signal units for proper hood and lens configuration and condition. (Per Conrail Standard Plan CS 6010)
2. Open door on signal and with light shining through lens inspect unit for signs of water, rust, discoloration and proper sealing.

Record results of inspection on Form C&S 102

At Least Once Every Two Years

C. Electrical Operating Characteristics

1. Searchlight Signal - Test must be made in accordance with the manufacturer's field requirements.

Record results of test on form C&S 7

TEST 9 - 106 RELAYS

(Rev. 1-03)

Test is to ensure that operating characteristics of electro-magnetic apparatus shall be maintained in accordance with the limits within which such apparatus is designed to operate.

Field tests on A .C. and D.C. relays shall be made in accordance with manufacturer's field requirements.

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At Least Once Every Year

A. All A .C. Centrifugal Relays.

At Least Every Two Years

B. All A. C. Vane Relays.
All D.C. Polar Relays.
All relays with soft iron magnetic structure (US&S Model 9C, 12, 13)

At Least Once Every Four Years

C. All vital relays, force drop type electric locks, (Model 10, SL21, 26) and equivalent electronic devices except those in tests A and B.

Record results of test on form C&S 7

TEST 10 - 109 TIME RELEASES, TIMING RELAYS AND TIMING DEVICES INCLUDING THERMAL RELAYS

Test is to ensure the specified time interval has elapsed.

At Least Once Every Year

Test shall be conducted by starting time release, timing relay or timing device and checking time from opening check contact (if used) until release of lever lock or energization of stick relay. Releasing time must not be less than 90% or exceed 10% of predetermined time interval which must be shown on plans or marked on the time release, timing relays or timing device.

Record results of test on form C&S 109

TEST 11 - 387 MOVEABLE BRIDGES

(Rev. 3-91)

The purpose of this test is to ensure proper maintenance and adjustment of moveable bridge apparatus to provide protection in accordance with approved plans.

At Least Once Every Year

Check adjustment of all circuit controllers in accordance with the following schedule:

Surfacing Wedges or Bridge Locks	Driven	1 in. full stroke
	Withdrawn	1 in. full stroke
Lift Rails or Rail Lift Beams	Raised	Lift rail clear fixed rail 2 in.
	Lowered	Top of lift rail 3/8 in. higher than top of fixed rail.
Rail Locks	Locked	Locking block 1 in. beyond far side of tongue.
	Unlocked	Locking block 1 in. clear of tongue.
Rail Locks	Locked	Through rail seat casting at least full thickness.
	Unlocked	Clear rail seat casting 1 in.
Latches	Raised	1 in. full stroke.
	Dropped	1 in. front seat.
Bridge Couplers	Driven	1 in. full stroke.
	Withdrawn	1 in. full stroke.
Bridge Seating Controllers	Closed	When bridge is 1/4in. from bridge seat

When moveable bridge is equipped with circuit controllers with mechanical rail locks, moveable rails shall be displaced 3/8 in. from their correct surface or alignment with adjacent fixed rail by an obstruction. With the moveable rail displaced, the rail lock shall not lock. This test shall be made for each rail lock on the bridge.

When moveable bridge is equipped with circuit controllers without mechanical rail locks, moveable rails shall be displaced 3/8 in. from their correct surface or alignment with adjacent fixed rail by an obstruction. With the moveable rail thus displaced, the miter rail controller contacts shall be opened.

This test shall be made on each miter rail on the bridge.

Record results of test on form C&S 387

TEST 12 -577 CAB SIGNAL TEST AND CUT IN CIRCUITS

This test is to ensure that cab signal test circuits and cut in circuits are functioning as intended.

At Least Once Every Year

A. Check test circuit for proper codes by manually operating test switch, where running test circuit is in service, check that all codes are present and in proper sequence. Measure axle current to determine that it is as near 2.5 amperes at the entering end.

To Be Made As Required

B. New installations must be given detail check promptly upon installation as indicated above, all subsequent changes of tracks, wires, relays, batteries or transformers must also be checked.

Record results of test on form C&S 577

TEST 13 - 105 ELECTRIC LOCKS (EXCLUDING FORCED DROP TYPE)

This test applies to electrical mechanical machines

Test is to ensure that operating characteristics of electric locks shall be maintained within the limits specified.

At Least Once Every Two Years

Test operating characteristics including pickup, release and working values. They may be recorded in either voltage or current values.

Record results of test on form C&S 7.

TEST 14 - 376 MECHANICAL INTERLOCKING

Test is to determine that mechanical locking is in accordance with the drawings and specifications, and in such condition as to ensure proper functioning.

Interlocking machines shall be tested when placed in service and thereafter when modified disarranged or:

At Least Once Every Two Years

A. Mechanical Locking

1. Inspect locking bed, supports and connections, driving pieces, dogs, stops, trunnions, etc., to see that they are properly secured. Splices in longitudinal locking bars must be straight, with bolts, nuts, and cotter pins in place.

2. Test each swing dog to determine that it releases properly.

3. Locking and connections shall be maintained so that when a lever or latch is mechanically locked the following will be prevented:

(a) MECHANICAL MACHINE

(1) Latch operating locking. Raising lever latch block so that bottom thereof is within 3/8 inch of top quadrant.

(2) Lever operated locking. Moving lever latch block more than 3/8 inch of top of quadrant

(b) ELECTRO-MECHANICAL MACHINE

(1) Lever moving in horizontal plane. Moving lever more than 5/16 inch when in normal position or more than 9/16 inch when in reverse position.

(2) Lever moving in arc. Moving lever more than 5 degrees.

(c) POWER MACHINE

(1) Latch operated locking. Raising lever latch block so that bottom thereof is within 7/32 inch of top quadrant.

(2) Lever moving in horizontal plane. Moving lever more than 5/16 inch when in normal position, or more than 9/16 inch in reverse position.

(3) Lever moving in arc. Moving lever more than 5 degrees

4. Test mechanical levers of electro-mechanical machines to ensure they cannot be operated except when released by electric levers.

5. Test latch shoes, rocker links, and quadrants of Saxby and Farmer machines to determine that locking will not release if a downward force not exceeding a man's weight exerted on the rocker while the lever is in the mid-stroke position.

6. Compare locking with dog chart to ensure they agree.

7. Using signal layout drawing and with locking bracket caps securely fastened in place - Test locking:

   (a) Between switch, derail and moveable point frog levers.

   (b) Between facing point and switch derail and moveable frog levers.

   (c) For each route,endeavor to raise latch or operate each signal lever which should be locked by the route, then raise latch on signal lever or reverse signal lever governing the route, and endeavor to raise latch or operate each lever which should be locked by the signal lever, then restore latch or lever to normal position, and make similar test with levers or latches for opposing signals.

   Test similarly for route and traffic levers.

   (d) For each route, endeavor to raise latch or operate lever for each signal that governs over route with trailing switch when the switch is in the wrong position.

   (e) Where facing point locks are used, set up each route, and endeavor to raise latch or operate the lever for each signal that governs over the route, with one switch at a time unlocked, and all levers in their proper positions.

   (f) Set up parallel routes and operate signal levers for movements in both directions on each route to determine that locking dogs do not interfere with the parallel routes.

B. Other Mechanical Parts

1. Check segments, quadrants, latches, etc. for wear and adjustment.

2. Indication mechanism must be tested to determine that no defects exist which will permit lever (single or double) to be moved beyond indication position until proper indication has been received. Test shall be made by moving lever several times from full normal and full reverse positions to the indication position at varying impacts against indication stop. When testing indication mechanism of lever, indication circuits must be opened. If any conditions are found that may cause improper operation, operator must be notified blocking device applied to lever and precautions taken immediately to provide for safe passage of trains.

C. Contact Springs, Rotary Type Controller.

1. Contact springs must have sharp (v shape) bend at contact point, and main stem of springs must be straight. Springs must be secured to the insulating bed plates by bolt that pass through the bed plates with not more than two wires connected to the same terminal post.

2. Contact and roller surfaces must be clean and dry, and free from lint.

3. Contact part of springs must meet contact bands evenly and squarely and circuits must open or close at the proper point of lever movement.

4. Check levers having 60 degree roller travel, to see that normal and reverse switch control bands, and NX and RY bands are on enlarged roller section.

5. Check adjustment of each segment with lever position as determined by the quadrant so that with lever at the indication of locking point of the quadrant, the protection on segment will clear the latch between .008 and .010 inch.

6. Check proper relation between segments and switch control band by holding up the reverse indication magnet and throwing lever so that the reverse safety tooth binds against and holds up the latch. With any lost motion taken out by turning the roller by hand toward full reverse position as far as possible, the reverse control band must be open not less than 1/32inch, and normal control band will be open slightly more. Repeat this test for operation toward normal side, checking adjustments in same manner.

7. Where Model 14 switch and lock movement type valves are in service, check to see that BD band, for control of lock magnet, remains open when the lever is moved from either the normal or reverse position against detector tooth lock.

8. Where a back contact of switch repeating relay is used for energizing the lock magnet of "CP" valve, check to see that "NX" and "RY" bands controlling this relay remain closed when the lever is against the detector tooth lock.

D. Adjustments of Model 12 or similar Electric Locks on Mechanical Machines.

1. Check cut and adjustment of segments as follows:

(a) Where latch is locked down as in detector or similar locking, locking dog must be free to drop to locked position with a 1/4 inch obstruction under bottom of latch rod, and latch cannot be raised more than 1/2 inch when in locked position.

(b) Where latch is locked up, as in signal indication or similar locking, latch must be held up by electric lock not less than 5/8 inch from normal position and locking dog must not bind on locking segment with latch raised and lever normal.

E. Mechanical Stick, Push Button Circuit Controller.

1. Check adjustment to assure that controller does not move toward the normal position enough to open the reverse contact until the lever has passed the indicating point going normal.

Record results of test on form C&S 376

TEST 15-377 APPROACH LOCKING

(Rev. 1-03)

Test is to ensure that the approach locking is effective when the approach circuit is occupied, signal cleared for a route and then lever restored to its full normal position or to normal indicating position if lever is equipped with electric lock, until a predetermined time has expired.

Approach locking shall be tested when placed in service and thereafter when modified disarranged or

At Least Once Every Two Years

A. Automatic Interlocking

1. Check that approach relay is open when each track circuit in the approach is shunted.
   (a) Clear home signal by placing a shunt in the approach circuit.
   (b) Place a shunt in the approach section or open the approach circuit of a conflicting route.
   (c) Operate the time release or push button for the conflicting route and determine that the home signal is restored to its stop indication.
   (d) Ensure that conflicting route is not established until after the prescribed predetermined time interval.
   (e) Ensure that loss of shunt of 5 seconds or less will not permit a established route to be changed or permit the release of route locking. All track circuits within the interlocking and approaches must be tested.

Note: Some automatic interlockings have superior routes that, when the approach section is occupied, causes cleared conflicting signals to display stop indication and timing relay to operate, and after expiration of the predetermined time interval, clears the signal governing the superior route. Some automatic interlockings have inferior routes that, when the approach section is occupied and home signal cleared, timing relay begins operating and, after the expiration of the predetermined time interval, restores the home signal to its stop indication. Regardless of the arrangement, changeover shall not occur until after the expiration of the prescribed time interval.

B. Electric Locks, Hand Operated Switches

1. Open HD line circuits by shunting track circuit at point of switch, ensure release circuit is not energized and switch cannot be operated.

Record results of test on form C&S109

TEST 16-378 TIME LOCKING

Test is to ensure that time locking is effective for a predetermined time after signal has been cleared for a route then restored to normal position.

Time locking shall be tested when placed in service and thereafter when modified, disarranged or;

At Least Once Every Two Years

A. Check time locking as follows:

1. Clear interlocking signal.
2. Restore signal lever to normal position or against the lock where lever is so equipped.
3. Check that all switches, conflicting signals, moveable point frogs, and derails in the route are locked. .After specified time interval has expired, check that locking is released.

Record results of test on form C&S 109

B. Check time locking on hand operated switch as follows:

1. Shunt track outside release section (where used).
2. Remove the padlock from a Model 10 or Model SL lock to initiate start of time interval.
3. Check that hand operated switch is locked.
4. After specified time interval has expired, check that switch is unlocked.

Record results of test on form C&S 103

TEST 17-379 ROUTE LOCKING

(Rev. 3-92)

Test is to ensure that route or other switch locking is functioning properly.

Route locking shall be tested when placed in service and thereafter when modified, disarranged or;

At Least Once Every Two Years.

Test shall be made as follows:

1. In Interlockings that provide release locking, visually inspect location of insulated joints to assure proper clearance is provided for all moves and insulated joints are installed in accordance with Standard Plan CS-9012, fig. B.

2. Identify and prove that each track and / or repeater relay responds to a shunt on its respective track circuit.
   (a) Where loss of shunt protection is provided:
      1. Open and close each control of each track relay, verifying that the corresponding lock relay remain in the de-energized position for a minimum of five (5) seconds after the track relay has re-energized. Repeat procedure for each circuit where loss of shunt is provided.

      2. When this has been done, the first track or track repeater relay may be opened in lieu of shunting each individual track circuit for the remainder of the test.

      3. Line switches, moveable point frogs and derails for the desired route and clear interlocking signal.

      4. Simulate a train movement on the first portion of the route by opening the track repeater for the track circuit immediately in advance of the signal.

      5. Restore interlocking signal lever to its full normal position or to its normal indicating position if lever is restricted.

      6. Momentarily open the track repeater of the next track circuit in the route to release the time locking (ASR circuit).

      7. When the time locking has released (AS relay in the up position for the track) check that all switches, moveable point frogs and derails in the route are locked.

8. Simulate a progressive train movement by opening the track repeater for the second track circuit in the route, allow the track repeater of the first track circuit to come up and check that all switches, moveable point frogs and derails in the occupied circuit and in advance of the occupied circuit are locked. All routes must be tested in each direction.

9. Repeat procedure detailed in Step 7 until each circuit has been occupied and released.

10. Each route must be tested in each direction. Where two or more signals have a common track circuit in advance of such signals, all routes must be checked for one of these signals and only one route need be checked for each of the remaining signals in that group. Also, where the last switches in a group are detector locked on a common track circuit, only one exit route need be lined over such track circuit.

Record results of test on form C&S 109

TEST 18-380 INDICATION LOCKING

(Rev. 1-03)

Indication locking shall be tested when placed in service and thereafter when modified, or disarranged.

On Installation and At Least Once Every Two Years

A. Signal Indication

Test shall be made as follows for processor based interlockings:

Test is to ensure that with a signal displayed over a route that no opposing or conflicting signals can be displayed and that all switches, moveable point frogs, and derails in the route are locked.

1. Line desired route and verify that when a signal is displayed that all switches, moveable point frogs, and derails are locked. Also verify any opposing or conflicting signals can not be cleared.
2. Test all remaining routes. If using SA mechanisms ensure they are poled both ways.

Test shall be made as follows for mechanical, electro-mechanical, or relay interlockings:

Test to ensure that the clearing of an interlocking signal de-energizes the associated indication lock or lock relay. Test shall be made to ensure the position of switches, derails, and moveable point frogs cannot be changed and conflicting signals cannot be cleared.

Procedure

1. Ensure that the RGP or lock relay is deenergized if any aspect other than stop is displayed by opening the lock circuit/RGP in each signal control relay.
2. Clear interlocking signal.
3. Open lock or RGP relay.
4. Restore lever to normal position or against the lock at the indicating position and ensure that timing relay is not operating
5. Check that all switches, moveable point frogs, conflicting signals and derails in the route are locked or signal lever equipped with indication lock cannot be restored to normal position and that opposing signal cannot be cleared.
6. Close lock or RGP relay.
7. Repeat for each signal.

Record results of test on form C&S 109

B. Switch Indication

Test is to ensure that signal cannot be displayed for a route in which each switch in the route has not operated in correspondence with the position of its controlling lever.

1.Interlocking Switches

Check switch indication on all switches as follows:

(a) Place a 1/2 inch obstruction in the open switch point and operate machine against the obstruction to ensure that switch correspondence relay is de-energized. Repeat procedure for opposite switch point and both ends of each crossover.

(b) With motor circuit of electric switch machine open to prevent operation of switch movement in both normal and reverse positions: switch should not indicate.

NOTE: When making above tests for traffic control system or relay type machine, observe switch repeating relays or switch indication lights to ensure proper operation.

2. Crossovers

On each crossover in addition to tests required in paragraph 1 check that both ends are normal to have normal repeater energized and both ends are reverse to have reverse repeater energized by using the following procedure:

(a) Open motor circuit on "A" machine and operate switch control lever to the reverse position. After "B" machine has completed its move to the full reverse position and locked up, check that the reverse and normal switch repeater relays are in the de-energized position.

(b) Close motor circuit on "A" machine and after machine has completed its move to the full reverse position, and locked up, observe that the reverse switch repeater relay is in the energized position.

(c) Open motor circuit on "A" machine again and operate switch control lever to the normal position. After "B" machine has completed its move to the full normal position and locked up, check that the normal and reverse repeater relays are in the de-energized position.

(d) Close motor on "A" machine and after machine has completed its move to the full normal position and locked up, observe that the normal switch repeater relay is in the energized position.

(e) Repeat steps (a) through (d) for "B" switch by opening its motor circuit in the same sequence as for switch "A".

3. Mechanical Switches:

(a) Where contacts of switch repeating relay are in F.P.L lock circuit. Obstruct each switch point with a 3/8 inch obstruction when switch operating lever is latched. F.P.L. lever should be electrically locked in normal position.

(b) Where contacts of switch repeating relay are not in F.P.L. lock circuit. Obstruct each switch point with a 3/8 inch obstruction. Switch should not indicate.

4. Electro-Mechanical Switches

(a) With switch and lever normal, obstruct reverse switch point.

(b) The lever is then placed in the reverse position.

(c) After machine has operated against obstruction, ensure that lever cannot be latched in the full reverse position.

(d) Repeat test in the opposite direction.

5. After each switch and crossover has been proven and identified the correspondence relay shall be de-energized to simulate an obstructed switch point. Proceed with test as outlined below:

(a) Check that the switch repeater of each switch in route causes signal to assume stop position.

(b) Repeat procedure for each switch and/or crossover in route.

(c) All routes must be tested.

Record results of test on form C&S 109

TEST 19 - 381 TRAFFIC LOCKING

(Rev. 1-03)

Test is to ensure that direction of traffic cannot be changed or opposing signals cleared while the section of track involved is occupied or signal is displayed for movement to proceed in to that track section.

Traffic locking should be tested when placed in service and thereafter when modified or disarranged.

Test to be made as required

1. Clear signal governing movement into track section.

2. Check that conflicting signal cannot be displayed.

3. Restore signal to normal position and ensure conflicting signal cannot be displayed while time locking is in effect.

4. Open first relay in track section, and ensure that conflicting signals cannot be cleared.

5. Close track relay.

6. Check each track circuit in track section.

7. Test must be made for every route.

8. Repeat test with traffic established in opposite direction.

Record results of test on form C&S 109

TEST 20 - 108 INSULATION RESISTANCE

Test is to ensure that the insulation of wires and cables, except track wires, line wires and case wiring meets with the resistance values shown below. This test also applies to wires and cables used for signal power.

Test must be made with direct reading instrument having a self-contained source of direct current test voltage. Scale of instrument must have minimum range of 0 to 20 megohms and be rated at 250 volts minimum, 650 volts maximum. Manufacturer's instruction for using instruments must be followed. Test must be made when wires, cables, and insulation are dry.

Test shall be made on new work, after installation and before being placed in service or

At Least Once Every Ten Years

1. Where conductor is found with insulation resistance of less than 500,000 ohms, Prompt action is required for repair or replacement of the defective wire or cable. Until repair or replacement is completed, insulation resistance tests must be made annually.

2. Where a conductor is found with insulation resistance of less than 200,000 ohms it shall be either repaired or removed from service.

3. Insulation resistance tests of each wire within trunking or within a cable must be tested to ground and tested against all other wires within the trunking or cable.

4. Single-conductor wire shall be tested to ground and is not required to be tested against all other wires in the cable run

5. Each conductor of a multiple conductor cable shall be opened at both ends when insulation resistance is being measured. When using Vibrotest instrument, one conductor shall be opened at both ends and tested for insulation resistance to ground. If insulation to ground meets requirements, the testing of insulation between this conductor and all other conductors in the cable may be made without disconnecting the other conductors. Continue this procedure to complete the insulation resistance test of all conductors in the cable.

6. When using other insulation test equipment, conductors of a multiple conductor cable must be opened at both ends before measuring insulation resistance between conductors.

7. Provisions of C&S 23 covering the use of jumpers, safeguarding of train movements and other safety precautions must be observed.

Record results of test on form C&S 108

TEST 21 TRACK CIRCUITS
(Rev. 1-03)

Test is to ensure reliable operation of track circuits.

To Be Made as Required

New Installations or Dis-arrangements- Changes to track structure (this includes replacing insulated joints), wires, relays, batteries, transformers, or other equipment must be given a detailed check per C&S 23 section 150. Perform the applicable tests outlined below.

A. Shunting - Test to ensure that all track circuits are adjusted to shunt at .06 ohms shunt maximum resistance at both ends of the circuit.

B. Cab Signal Axle Current - Test is to ensure reliable operation of wayside cab signal system. Verify minimum current at the entering end is 2.2 - 2.5 Amperes.

TEST 22 -234 AUTOMATIC AND MANUAL HIGHWAY GRADE CROSSING WARNING DEVICES

(Rev. 1-03)

This test is to ensure that all equipment in connection with each highway grade crossing warning system is functioning as designed. Following these instructions, in combination with **Test 9-106 RELAYS, Test 20-108 INSULATION RESISTANCE, and Test 24 INSULATING RAIL JOINTS** will comply with requirements of **FRA Rules 234.247 through 234.273.**

PERSONAL SAFETY- Employees performing Test 22-234 must wear prescribed personal protective devices, including high visibility clothing.

Record results of Test 22-234 A, B, C, and D on form C&S 15.

Record results of test 22-234 B-13 on form C&S 24

At Least Once Every Month.

Part A

1--OBSERVE RELAYS- Observe that line control and/or track relay and directional stick or interlocking relays are in their normal operating position.

2--FLOAT VOLTAGE- (Main Case) Measure voltage of main batteries and track cells while on charge. Values must be in accordance with the values shown on C&S 23, 900 Section for the type of cell or rectifier and should be adjusted for those values. Record on **C&S 15.**

3--STANDBY POWER- Open AC power feed to place installation on stand-by battery.

4--SYSTEM OPERATION- Operate the system a minimum of two minutes. (At crossings equipped with gates, the operation of the gates down and up three times may be used in lieu of two minutes of flashing light operation). Test highway traffic signal preemption interconnections for which the railroad has maintenance responsibilities, if so equipped.

5--CLEAN and INSPECT FLASHING LIGHT UNITS- Wipe dust off flasher roundels using soft cloth and appropriate cleaner if necessary. Inspect each unit for proper visibility. Observe that roundels and reflectors are in good condition. Insure dust and moisture can not enter unit.

6--OBSERVE OPERATION- Confirm that lamps have normal brilliance, that there are no burned out lamps, and that auxiliary devices such as crossing bells and No Turn signs are operating properly. Observe that no obstruction interferes with view of lamps. Observe that gates operate properly.

7--FLASHERS & GATES- Inspect each gate and gate mechanism. Insure lights and wires are securely fastened to the gate arm. Gate length should be according to the design length or 90% of each approaching lane of traffic if not specified.

8G--SHEAR PINS- Check that shear pins for break away gate arms are in accordance with Standard Plan CS-1001.

9--LOADED VOLTAGE- Measure voltage of main batteries and track cells at the crossing while charge is off and batteries are supplying the lighting load. **Record on C&S 15 monthly and C&S 28 battery card quarterly.**

10--INSPECT BATTERIES- Inspect main and track batteries at the highway location for height of electrolyte, where applicable, as well as tightness of connections and cleanliness.

11--AC & DC GROUNDS- Ground test is to be made with lights flashing. While AC Power is off test for grounds. Restore AC Power and test for Grounds. **Record results of test on form C&S 107.**

12G--GATE GROUNDS- Check for grounds while gates are moving to vertical position.

At Least Once Every Three Months

PART B

4G--GATE TIMING- Electric gates must start down 3 to 5 seconds after flashing lights start to operate. Gates must reach full horizontal position 10 to 15 seconds after starting down. Electric gates must raise to full upright position in no more than 12 seconds after gates are permitted to clear.

6--VISIBILITY- Check visibility and alignment of signals, visibility and condition of signs including CC signs or equivalent.

13--WIRES, BONDS, & INSULATING JOINTS- Visually inspect all track wire connections and bonds within the approaches to the crossing. Perform C&S 27 test 24-(Insulating Rail Joints) in conjunction with this Inspection. **Record on form C&S 24.**

14--INSPECT BATTERIES- Inspect main and track batteries at highway approach locations for height of electrolyte, where applicable, tightness of connections and cleanliness.

15--APPROACH BATTERY VOLTAGES- (Approach Locations) Measure voltage of main batteries and track cells while cells are on charge. Values must be in accordance with the values shown on C&S 23, 900 Section for the type of cell or rectifier and should be adjusted for those values. With power off, check and record voltages. **Record battery and individual cell readings on battery record card C&S 28 and C&S15.**

16--PRIMARY BATTERIES- Check primary battery renewal date.

17--SWITCH CUT-OUT CIRCUITS. In non-signal territory where circuit controllers are in service on outlying switches to cut out operation of crossing system, test each circuit controller with 3/8 inch obstruction between switch point and stock rail when the switch is reversed and observe that cut out does not function. Cut out must function as intended with an obstruction of 1/4 inch. (In signaled territory, Test 2-103D paragraph 3 will govern.)

18- PUSH BUTTON CUT-OUTS Check operation of push-button cut-outs when so equipped.

19- GROUNDS - Test for grounds at approaches. **Record results of test on form C&S 107.**

At Least Once Every Year

PART C

1--OPERATE STICK RELAYS Where warning device utilizes directional stick relays, check operation for each track in each direction and after tests are completed, observe that the directional stick relays are de-energized. Where stick release timers are used, check that directional stick relays become de-energized after the specified time. Faults shall be reset after test.

6--FLASHER RATE - Check number of flashes per minute. If found to be less than 35 or more than 65 arrange for correction.

7--GATE TORQUE. Check gate arm torque in accordance with manufactures instruction to ensure that gate arms are free from friction or other interference that might prevent them from functioning as intended.

8- HOLD CLEAR Test hold clear device for proper visual operation.

10--ELECTROLYTE Take specific gravity readings of all lead acid wet cells at main and approach locations before addition of water. Reading must be in accordance with C&S 23 section 900 and **recorded on battery record card C&S 28.**

12--FLASHER CONTACTS-Check flashing contacts by observing that at least one lamp in each crossarm is burning and all lamps are synchronized when flasher is at rest.

13--LAMP VOLTAGE Check voltage at lamps after AC power has been off and flashers have operated for at least 2 minutes. Flasher relay should be de-energized when voltage readings are taken. Voltage at lamp shall be at least 8.5 volts DC and not more than 9.5 volts DC for a lamp rated at 10 volts. Re-check lamp voltages after power is restored. Gate arm lamp voltages should be checked at junction box or gate mechanism case.

20--TIMING CIRCUITS Check timing relays, timing devices, and time delay of starting circuits. Time shall not exceed that shown on plan. Check time delay of cut out circuits. Time shall not be less than 90 nor more than 110 percent that shown on plan. **Record results of test on form C&S 109.**

21- WARNING TIME Verify warning time provided is according to plan.

22 - TRANSFER SWITCH Check operation of automatic - manual transfer switch when so equipped.

23. VERIFY EQUIPMENT TO PLAN - Check that equipment at location reflects that shown on the circuit plans and all tagging is in place.

At Least Once Every Year

PART D - ELECTRONIC DEVICES

1. Grade crossing predictors, motion sensors and overlay track circuits shall be tested in accordance with manufactures instructions, C&S 23 section 505 and the following test shall be performed to determine if an interfering signal is present at the receiver input:

a. Disable associated transmitter output.

b. With frequency selective voltmeter connected at receiver input check signal level at receiver frequency. Signal level must be at least 6db below the receiver sensitivity as listed in the manufacturers specifications.

c. If a foreign signal is detected as in **b** above, its source will be determined and corrected at once.

Record Results of test on form C&S 15

TEST 24 - INSULATING RAIL JOINTS AND SWITCH INSULATION

Test is to ensure insulation material is in proper condition.

At Least Once Every Three Months

If visual inspection indicates poor condition of insulation, report location to Supervisor Track and Supervisor Signals.

Record results of test on form C&S 24

TEST 25 - WAYSIDE ELECTRIC LOCKS

Test is to ensure that hand operated switch cannot be operated if Electric Lock is de-energized.

Annually or when padlock or other components are changed.

1.Open positive coil wire of electric lock.

2.Remove padlock and attempt to throw switch stand lever.

3.Ensure that locking cam covers switch stand lever by 3/8 inch for GRS Model 9B and US&S model locks ensure that plunger is through lock rod by a minimum of 3/8".

4.Close positive coil wire and ensure that unlock indication (if present) is displayed and that switch can be operated.

5.Operate switch stand lever to reverse position and ensure that bayonet prevents switch from being locked.

6.Inspect electric lock mechanism and contacts and ensure that they are in proper working condition.

7.On electric locks without pipe connected derails, place a hard wire shunt at the switch points and ensure that the electric lock is not energized and that the switch stand lever cannot be lifted from keeper. Ensure that series or short range overlay track relay is de-energized.

8. Place a hard wire shunt 15-20 feet from the switch points and ensure that the series or short range overlay track relay is energized.

Report results of test on form C&S 47

TEST 33 - AUTOMATIC INTERLOCKING

In addition to tests prescribed for interlockings, the following tests shall be made:

At Least Every TwoYears

1. Open or shunt each track circuit between interlocking signals and check to see that no conflicting interlocking signals can be displayed.

2. Shunt each track circuit in sequence to correspond with the passage of a train on each route to determine that interlocking is released as the rear of the train leaves the interlocking.

3. Check manual release circuits to see that they operate properly by displaying signal for a route, then shunt approach on conflicting route and operate manual release. This test must be made for each signal and route.

4. Check to see that proper aspect is displayed on operative approach signals in accordance with the aspect of the interlocking signals.

5. Check to see that recording devices are operating according to manufactures specifications and instructions.

6.Where special features exist, such as supervisory control of signals, cut outs for shifting movements means for engines returning to their trains, etc., operation should be checked, including time intervals if involved.

Record results of test on form C&S 47.

TEST 36 - RESISTANCE OF MADE GROUNDS

(Rev. 1-03)

Test is to ensure that grounds are maintained at proper resistance.

In testing protector grounds on power lines, test apparatus shall be connected at the ground rod, and careful visual inspection shall be made of the ground wires. In test of other protector grounds, connections shall be made at the arrester, for the purpose of checking the wire and connections, in addition to the actual ground.

At Least Every Three Months

A. Perform visual inspection of grounding wires and connections to ensure integrity. Promptly repair any defects.

Record results of inspection on form C&S 47.

As Required

B. When installing or modifying grounding systems, all possible effort in accordance with Standard Plan 9002 shall be made to obtain the lowest possible resistance to ground.
Resistance of ground shall be tested and recorded at initial installation and 30 days after.

Record test results on form C&S 50

TEST 37 - TRAIN INSPECTION DEVICES
(Rev. 1-03)

Test is to ensure that equipment is operating as required and maintained in good condition.

HOT BEARING DETECTORS

All HBD locations are to have an up to date logbook with an entry for every test, repair, or inspection, with a printed copy of the current parameters being retained at the site. Conrail Cyberscan 2000 currently utilizes supplement dated 08-07-2001.Any time a scanner is removed or replaced calibration and alignment must be performed per manufacturer's instructions.

At Least Biweekly

A. 1. Check protector ramps and flanger signs. Repair or replace if necessary. Refer to Conrail M&W Standard Plan 78460-D.

2. Check scanners and transducers for damage and loose hardware. Make any necessary repairs.

3. Check scanner shutters for free operation when opening and closing.

4. Check operation of heaters in the scanners.

5. Push reset test button on the "D" board to test system, "System working" should be broadcast from the local speaker.

At Least Once Every Month

B. 1. Check mirrors and lenses. Clean as required, using only denatured alcohol and water or anti-fog solution.

2. Calibrate HBD system with the SERVO function simulator (calibrated heat source) and record in Logbook. Calibration must be performed immediately after any adjustments are made to the HBD system.
See Cyberscan 2000 manual TM 92-11-01 for detailed procedures.

NOTE: Do not attempt to calibrate system if ambient temperature is above 90° F or below 20° F, unless necessary due to repair or replacement.

3. Check that equipment and cables connections are tight.

At Least Once Every Three Months

C. 1. Inspect terminations on track side equipment, clean and tighten if necessary.

2. Clean scanner with solvent or detergent and paint with aluminum paint as required.

3. Instrument enclosures shall have vents open and cooling equipment operational from April to October and vents closed and heating equipment operational from October to April. Clean or replace vent filters.

4. Check for proper scanner alignment and transducer location per Cyberscan 2000 manual TM 89-05-09.

DRAGGING EQUIPMENT DETECTORS

Test is to ensure the dragging equipment detector circuits are in proper working order to sound alarm.

At Least Once Every Month

D. Test shall determine that pressure required to rotate paddles, and the deflection at which contacts open (in each direction) shall be in accordance with instructions furnished by manufacturer and shall not exceed a maximum of 15 degrees to open contacts and 10 degrees to close contacts. For Harmon detectors 10 degrees is equal to 2 inches from center and 15 degrees is equal to 2.5 inches from center. Refer to manufacturer's instructions for detailed procedure.

Record results of test on form C&S 47.

HIGH LOAD DETECTOR

At Least Once Every Three Months

E. Pass pole of non-conducting material with surface no more than 1.5 inches between light and receiver. Height of pole above top of rail for testing high load detector must be equal to the specified height for the detector at that location. Check that each passing of pole between light and receiver actuates alarm and proper radio message is transmitted.

Record results of test on form C&S 47.