AMT-27

INSTRUCTIONS
FOR TESTING
SIGNAL APPARATUS
AND SIGNAL SYSTEMS

COMMUNICATION AND SIGNAL DEPARTMENT

INSTRUCTIONS FOR TESTING SIGNAL APPARATUS AND SIGNAL SYSTEMS

AMT-27

Issued By: [redacted]
E. Keith Holt
Deputy Chief Engineer C&S

DCN: 04.03.AMT-27 Issued: 04/01/1999

INSTRUCTIONS FOR TESTING SIGNAL APPARATUS AND SIGNAL SYSTEMS

AMT-27

Issued By [redacted]
E. Keith Holt
Deputy Chief Engineer C&S

DCN: 04.03.AMT-27
Status: Approved
Rev 05 08/01/2006
Baseline: 04/01/1999

Recipient,

Please remove and sign this page. Return it to the issuing officer.

I received a copy of the AMT-27,
Instructions for Testing Signal Apparatus and Signal Systems.

Date: _____

Signature: _____

Print Name: _____

COMMENTS PAGE

Your comments on the AMT-27 are invited. Please send all suggestions to:

Sr. Director C&S Maintenance
c/o Deputy Chief Engineer- C&S Office
30th Street Station- 4th Floor
South Tower- Box- 41
Philadelphia, PA 19104

Please include with each suggestion:

Test # _____

Subpart (letter) _____

Subsection # (if any) _____

Page # _____

Recommended Changes, Corrections or Questions

_____

_____

_____

_____

_____

Submitted by: Name _____

Address _____

_____

Phone _____

NOTE: Test Numbers 5, 6, 12, 21, 33, 35, 37, 38, and 40 are intentionally omitted.

LIST OF FIGURES

(Figure numbers refer to test where they appear.)

LIST OF FORMS

(All forms are in the APPENDIX.)

LIST OF FORMS (cont.)
(All forms are in the APPENDIX.)

LIST OF TABLES
(Table numbers refer to test where they appear.)

AMT 27 "Revisions"

Test #	Page #	Rev.	Date
Signature Page		03	10/24/03
Comments Page		03	10/24/03
Table	i -iii	03	10/24/03
Table	i - iv	01	11/01/00
Table	v - vi	03	10/24/03
#2A	2 of 5	03	05/15/14
#2A	3 of 5	02	03/01/06
#2B	5 of 5	02	05/15/14
#3	1 of 3	01	03/08/05
#3	2 of 3	03	03/08/05
#3	3 of 3	03	03/08/05
#4	1 of 8	04	03/01/06
#4	2 of 8	04	03/01/06
#4B	4 of 8	03	03/01/06
#4D	8 of 8	03	10/24/03
#7	2 of 4	01	11/01/00
#7	2 of 4	03	10/24/03
#7	3 of 4	01	11/01/00
#7	1 of 4	03	10/24/03
#8	1 of 2	03	10/24/03
#8	2 of 2	03	10/24/03
#9	1 of 2	03	10/24/03
#10B	2 of 3	01	11/01/00
#10C	3 of 3	01	11/01/00
#10C	3 of 3	03	10/24/03
#11A	2 of 10	04	03/01/06
#11C	4 of 10	01	11/01/00
#11D	7 of 10	01	11/01/00
#11D	7 of 10	03	03/01/06
#11D	8 of 10	03	10/24/03
#11E	9 of 10	04	03/01/06
#14B	2 of 6	01	11/01/00
#14D	3 of 6	03	08/31/06
#15B	4 of 6	03	10/24/03
#15C	4 of 6	03	10/24/03
#15C	5 of 6	03	10/24/03
#15C	6 of 6	03	10/24/03

#16C	3 of 4	01	11/01/00
#18	1 of 3	05	8/24/2013
#19A	2 of 4	02	09/01/01
#19A	2 of 4	03	10/24/03
#19B	3 of 4	02	09/01/01
#19C	3 of 4	02	09/01/01
#20A	1 of 9	01	11/01/00
#20A	2 of 9	02	03/01/06
#20A	5 of 9	02	03/01/06
#20B	4 of 9	01	11/01/00
#20B	5 of 9	02	03/01/06
#20C	5 of 9	01	11/01/00
#20D	6 of 9	01	11/01/00
#20E	8 of 9	03	10/24/03
#20E	9 of 9	03	10/24/03
#22	ALL (11)	04	03/01/06
#23A	1 of 13	03	10/24/03
#23A	4 of 13	04	03/01/06
#23A	6 of 13	03	03/01/06
#23B	5 of 13	01	11/01/00
#23B	7 of 13	03	10/24/03
#23B	7 of 13	04	10/19/04
#23C	8 of 13	01	11/01/00
#23D	9 of 13	03	10/24/03
#23D	10 of 13	03	10/24/03
#23D	11 of 13	03	10/24/03
#23D	12 of 13	03	10/24/03
#24A	3 of 16	03	10/24/03
#24A	3 of 16	05	03/01/06
#24A	4 of 16	03	10/24/03
#24B	4 of 16	01	11/01/00
#24B	5 of 16	03	10/24/03
#24C	5 of 16	02	09/01/01
#24C	6 of 16	02	09/01/01
#24C	7 of 16	03	10/24/03
#24D	1 of 16	03	10/24/03
#24D	8 of 16	03	10/24/03
#24D	9 of 16	01	11/01/00
#24D	9 of 16	02	09/01/01
#24D	9 of 16	02	09/01/01
#24D	10 of 16	01	11/01/01
#24D	10 of 16	03	10/24/03

#24D	10 of 16	05	03/01/06
#24D	11 of 16	05	03/01/06
#24E	12 of 16	03	10/24/03
#24F	14 of 16	01	03/01/06
#26A	3 of 8	02	09/01/01
#26A	4 of 8	04	03/01/06
#26B	5 of 8	04	03/01/06
#26C	7 of 8	04	03/01/06
#26C	8 of 8	04	03/01/06
#27	1 of 1	01	11/01/00
#28	ALL (4)	02	09/01/01
#28B	3 of 12	01	09/01/01
#28C	1 of 12	03	10/24/03
#28C	5 of 12	03	10/24/03
#28C	6 of 12	05	03/01/06
#28C	7 of 12	05	03/01/06
#28C	8 of 12	05	03/01/06
#28C	9 of 12	05	03/01/06
#28C	11 of 12	05	03/01/06
#28D	1 of 12	03	10/24/03
#28D	2 of 12	03	10/24/03
#28D	5 of 12	03	10/24/03
#28D	6 of 12	03	10/24/03
#28D	12 of 12	05	03/01/06
#28	ALL (20)	06	12/04/15
#29B	2 of 3	03	03/08/05
#29C	3 of 3	03	10/24/03
#31A	2 of 2	01	03/01/06
#32A	3 of 7	03	10/24/03
#32A	4 of 7	03	10/24/03
#32A	4 of 7	04	03/08/05
#32A	5 of 7	03	10/24/03
#32B	6 of 7	03	03/01/06
#36A	1 of 2	02	03/01/06
#36B	2 of 2	02	03/01/06
#39A	1 of 2	02	09/01/01
#39B	2 of 2	02	09/01/01
Forms	1 of 12	01	11/01/00
Forms	10 of 12	02	08/01/06
Forms	12 of 12	02	08/01/06

GENERAL

The Communication and Signals Department must continually maintain the communication and signal network to the highest standards of safety and reliability. These standards must insure that in no instance either safety or reliability are being compromised by the failure of equipment or personnel. To this end definitive test and inspection procedures have been established to provide for the quality assurance and quality control of all functions of the Communication and Signals Department. The AMT–27 defines these requirements. As an operating railroad company within the United States, Amtrak is governed by certain regulations administered by the Department of Transportation Federal Railroad Administration (FRA). Title 49 Part 236 and Title 49 Part. 7 234 of the Code of Federal Regulations governs the Rules, Standards, and Instructions (RS& I) for the installation, inspection, maintenance, and repair of signal and train control systems, devices, and appliances. All federally mandated tests and inspections in accordance with 49 CFR.236 and 49 CFR.234 which are applicable to Amtrak, are included as part of the AMT– 27, in addition to other tests required by Amtrak.

In order to provide a safe, reliable and efficient Communication and Signal System, employees charged with making tests and inspections must adhere to the following:

1. Normal functioning of any device shall not be interfered with during testing without first taking measures for insuring the safety of train operation.
2. 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.
3. When switch, signal or other circuits are used for temporary telephones, it must be determined that such use will not affect the circuits.

4. Tests of signaling and interlocking devices must be made periodically as specified and more frequently or with more stringent requirements when conditions warrant.
5. Additional tests, when required, must be made in accordance with instructions issued in connection therewith.
6. 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. If the failed apparatus could cause an unsafe condition, protection must be provided immediately and maintained until condition is corrected (See **AMT-23, Rule 52**).
7. Employees qualified to perform tests are listed for each test. Employees who are not listed, if qualified, may be assigned to make the test specified.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.376

Purpose:
This test is to determine that mechanical locking and associated appliances are in accordance with the drawings and specifications, and in such condition as to insure proper functioning.

Responsibility:
Foreman C&S, Inspector C&S, Asst. Inspector Test, Maintainer C&S Test, and Signal Inspector.

Records:
Results of Test 1 on Mechanical Interlocking Machines shall be recorded on Forms C&S-27.

Results:
Any defects or discrepancies discovered during testing shall be so noted on Form C&S-27 and immediately corrected. If defects cannot immediately be corrected, arrangements must be made for the safe passage of trains.

TEST 1A
MECHANICAL LOCKING

Frequency:
At Least Once Every Two Years or If Locking Is Changed or Disarranged.

Procedure:

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 must be 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 Operated Locking:
      Raising lever latch block so that bottom thereof is within 3/8 inch of top of quadrant.

      2) Lever Operated Locking:
      Moving lever latch block more than 3/8 inch on 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.

      3) 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 of quadrant.

      2) 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.

3) Lever moving in horizontal plane. Moving lever more than 5 degrees.

4. Test mechanical levers of electro-mechanical machines to insure they cannot be operated except when released by electric levers.
5. Test latch stops, 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 is exerted on the rocker while the lever is in the mid-stroke position.
6. Compare locking with dog chart to insure 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 lock and switch, derail and moveable point frog levers.
   c. For each route, endeavor to raise the latch or operate each signal lever which should be locked by the route, then raise the latch on the signal lever or reverse signal lever governing the route. Endeavor to raise the 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 the 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.

TEST 1B
OTHER MECHANICAL PARTS

Frequency:
At Least Once Every Two Years or If Locking Is Changed or Disarranged.

Procedure:

1. Check segments, quadrants, latches, magnets, 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.
3. Tests shall be made by moving the lever several times from full normal to full reverse positions to the indication position at varying impacts against indication stop. When testing the indication mechanism lever, indication circuits must be opened. If any conditions are found that may cause improper operation, operator must be notified, blocking device must be applied to lever and precautions must be taken immediately to provide for safe passage of trains.

TEST 1C
QUICK SWITCH

Frequency:
At Least Once Every Two Years or If Locking Is Changed or Disarranged.

Procedure:

1. Test switch to insure proper operation of quick switch as follows:
   a. Operate lever from normal against reverse indication tooth and from reverse against normal indication tooth. Quick switch should not operate.
   b. Operate lever against 3/16-inch gauges placed against the normal and reverse shoulders of the lever quadrant. Quick switch should operate to full normal or reverse positions.
   c. Manually place each quick switch in center position and operate lever between indicating positions. Quick switch should shift to normal or reverse position.
   d. Failure of the quick switch to operate under any of the above tests may be due to dirty or worn parts, improper lubrication, weak toggle springs, lever not properly centered with relation to roller, contact springs too tight on quick switch, or quick switch resting on top of supporting brackets on frame of machine.

TEST 1D
CONTACT SPRINGS, ROTARY TYPE CONTROLLER

Frequency:
At Least Once Every Two Years or If Locking Is Changed or Disarranged.

Procedure:

1. Contact springs must have sharp (V shaped) bend at contact point. Main stem of springs must be straight. Springs must be secured to the insulating bed plates with no more than two wires connected to the terminal posts.
2. Contact and roller surfaces must be clean, 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 controller bands, and NX and RY bands are on enlarged roller sections.
5. Check adjustment of each segment with lever position as determined by the quadrant so that, with lever at the indication or locking point on the quadrant, the projection of 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 the lever so that the reverse safety tooth binds against and holds 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 1/32 inch, and normal control band will be open slightly more. Repeat this test for operation toward normal side, checking adjustments in same manner.

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

8. Where "BD" band energizes lock magnet of "C" or "CP" valves (S-822, Figs. 1A & 1B), or where "NX" or "RY" bands are in control of switch correspondence relay (S-822, Fig 4C), check to see that lock magnet remains de-energized (down) when lever is moved from either normal or reverse position against detector lock tooth. Be certain that lock magnet picks when lever is between "B" and "D" positions.

TEST 1E
ADJUSTMENT OF MODEL 12 OR SIMILAR ELECTRIC LOCKS ON MECHANICAL MACHINES

Frequency:
At Least Once Every Two Years or If Locking Is Changed or Disarranged.

Procedure:

1. 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 ¼ inch obstruction under bottom of latch rod, and latch cannot be raised more than ½ inch when in locked position.

b. Where the latch is locked-up as in signal indication or similar locking, latch must be held up by electric lock not less than 3/8 inch from normal position, and locking dog must not bind on locking segment with latch raised and lever normal.

TEST 1F
MECHANICAL STICK PUSH BUTTON CIRCUIT CONTROLLER

Frequency:
At Least Once Every Two Years or If Locking Is Changed or Disarranged.

Procedure:

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

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.108, 234.267

Purpose:
Test is to insure that the insulation of wires and connected apparatus meets with resistance values presented below.

Responsibility:
Assistant Inspector Test, Maintainer C&S Test, or Signal Inspector.

Records:
Record of tests must be made on the appropriate form (Forms C&S 2.0, 2.1, and 2A), or MAXIMO where using ACM. All values must be recorded. The form must indicate the corrective action taken with those wires not meeting minimum requirements. Use the pink C&S 2A form to record cables with values less than 500,000 ohms.

Results:
Wires with insulation resistance below 1 megohm must be reported to Supervisor C&S, who must report this to Asst. Division Engineer C&S.
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 form. Use remarks column if necessary.

TEST 2A
LOW VOLTAGE (660 VOLTS OR LESS) WIRES OR CABLES; MINIMUM ALLOWABLE RESISTANCE 500,000 OHMS.

Frequency:

1. **At least once every ten years.**
   a. All wires and cables except as noted. Wires and cables except house and case wires which shall be tested on an as required basis.
   b. Local signal lighting circuits, switch control and indication circuits, and local wiring in any other circuit controller or signal device not housed in a signal housing such as a bungalow or relay case. This includes local wires within signal heads, signal masts, switch machines, junction boxes, circuit controllers of all kinds, CP valves, highway crossing signals, masts, bells, gate mechanisms, dragging equipment detectors, and all other signal apparatus located external to bungalows and relay cases.

2. **At least once every five years**.
   a. Wires and cables with insulation and protective outer covering not designed for underground use, any part of which is underground or in trunking.

3. **At least once every twelve months.**
   a. Wires and cables found having one or more working conductors with insulation resistance less than 500,000 ohms, but not less than 200,000 ohms, until cable or wiring is replaced.

NOTE: Wires connected directly to track rails need not be tested. Communications type wires and cables need not be tested.

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 or buss. When operated, the megger must read zero resistance.
3. Tests shall be made when wires, cables and insulation are dry.
4. Provisions of AMT 23 covering the use of jumpers, and safeguarding 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 resistance to ground.
7. Have the person at the opposite end of the wire insure continuity by grounding that end of the wire. Megger must read zero.
8. If insulation resistance to ground meets requirements, the testing of insulation between this conductor and all other conductors may be made without disconnecting the other conductors. Continue this procedure to complete the insulation resistance test of all conductors in the cable.

NOTE: When using hand-cranked insulation test equipment, conductors of a multiple conductor cable must be opened at both ends before measuring insulation resistance between conductors.

TEST 2B
SIGNAL POWER CABLES, AERIAL AND UNDERGROUND: (For circuits exceeding 660 volts)

Minimum Allowable Resistance – 40 Meg Ohm (100 megohm for new installation)

Frequency:
At least every 10 years

Procedure:
Refer to Test 2A Procedure

TEST 3: FOREIGN CURRENT – DC & 60 HZ. NON-CODED TRACK CIRCUITS

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	NONE

Purpose:
Test is to determine the presence of foreign current and insure proper corrective action to prevent interference with track circuits.

Responsibility:
Assistant Inspector Test, Maintainer C&S Test, or Signal Inspector.

Records:
Test results shall be recorded on Form C&S-27.

Results:
If any appreciable readings are obtained in either test, or track relays attempt to pick, report the readings to the Supervisor C&S.

Note: *Foreign current tests need not be made where foreign current protection is provided; where coded current is used for wayside signal control; where there is No apparent source of foreign current such as trolley lines; parallel power lines, etc., or where for a three year period there is No evidence of foreign current where it had previously existed; however, where the source is still in existence, tests shall be continued at three year intervals to detect recurrence of foreign current.*

Under certain conditions there is a storage battery effect between the rails, and ballast that may have current value sufficient to hold the relay closed several minutes after the battery feed wires have been disconnected. If such condition is observed, either short circuit the rails temporarily or wait a sufficient

time for the amperage to drop before deciding that foreign current exists.

TEST 3A
D.C. NON-CODED TRACK CIRCUIT

Frequency: At least once a year where foreign current exists. **See Note!**

Procedure:

1. Where there is known to be a D.C. trolley line, high voltage D.C. power line, or other direct current exposure, tests should be made during periods in which the outside current is at or near maximum value.
2. This test shall be made by placing a milliammeter in series with the track relay, then disconnecting the wires from the battery and taking a reading. It should be noted at the same time whether the current is equal to or in excess of 75 percent of release value of the relay
3. If the current is not 75 percent of the release value of the relay, a second test should be made in the same manner as the first. In addition to performing a second test, shunt the track circuit adjacent to the relay end of the circuit under test (shunt on the opposite side of the insulated joint from the relay connection), and then shunt one insulated joint at a time between the track circuits.
4. Add the rails of the adjacent track circuit to one side of the track circuit under test to provide an unbalance and make a severe test. If current is 75 percent or more of release value of relay, the circuit should also be watched.

If any appreciable readings are obtained in either test, report the readings to the Supervisor C&S. In addition the following precautions shall be observed.

1. Where trolley, transit, subway, mining companies, and other sources of D.C. are present, request to see if their bonding is as good as practicable.

2. Rail joints shall be kept tight, and insulated joints maintained in good condition.

3. Rail bonding carefully maintained.

TEST 3B
60 HZ NON-CODED TRACK CIRCUITS

Frequency:
At least once a year where foreign current exists.
See Note!

Procedure:

1. This test is made by removing energy at the feed end of the track circuit to be checked.
2. Shunt the track circuit adjacent to relay end of the circuit under test, and then shunt one insulated joint at a time between the track circuits.
3. Insure that the track circuit does not attempt to pick.
4. Where a three position relay is in service, one shunted insulated joint will tend to cause relay contacts to move towards the normal position while the other will tend to cause relay contacts to move towards the reverse position. An AC track circuit with rectifier at the D.C. relay end, and Type C track circuit with diode at opposite end will also respond to AC foreign current.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.102a., 236.105, 236.106, 234.263

Purpose:

Test is to insure that operating characteristics of electro-magnetic apparatus and vital electronic relay devices shall be maintained in accordance with the limits in which an apparatus is designed to operate.

Responsibility:

Assistant Inspector Test, Maintainer C&S Test, or Signal Inspector.

Records:

Record operating characteristics in duplicate on C&S-4 or NEC 70. One copy is to be retained at location and the original is to be filed at test headquarters.

Results:

Any relay, electro-mechanical device, or vital electronic relay device, that is found to be out of scope as per Test 4, shall be removed from service and replaced immediately. If the relay cannot be replaced immediately, the Supervisor C&S must be notified and arrangements made for the safe passage of trains.

ALL RELAYS

Inspection Procedure:

1. Verify index plate registration for each plug-in relay.
2. Observe that all parts of the relay are in good condition and in correct position with respect to other parts. Check that nomenclature tag is legible.
3. Insure that the glass cover is not cracked, broken, smoky, or discolored.

4. Observe that the ribbons are intact and in good condition and that the contacts are not worn, charred, or pitted.
5. Insure that the contacts are in alignment and contact openings are sufficient.
6. Insure that no moisture has accumulated inside of the relay, or Relay Shop Test Tags have come unattached from inside the glass.
7. Determine by actual operation that the relays have a positive drop-away and that the relay opens without any hesitation due to friction or other reason.
8. When inspecting centrifugal type track relays, ensure that excessive oil has not accumulated on contacts, glass, rotor, etc.
9. When inspecting vital electronic relay device, ensure that glass covers are not cracked, broken, or discolored. Verify that all seals are intact, and visible circuit boards have no burn marks or evidence of surge damage.

Test Procedure:

1. Field tests on DC and AC relays, shall be made in accordance with manufacturer's instructions for field tests. In all cases, apparatus must comply with the manufacturers' instructions for field test.

TEST 4A

Frequency:

At least once every four years.
All relays the function of which affects safety of train operation, except those listed in Test 4B and Test 4C below.

D.C. Neutral Relays Test Procedure:

1. Disconnect wires from the relay operating coil or pull plug-in relay from the rack. Apply test set.
2. Apply an initial charge of energy to the coil of the D.C. neutral relay with the usual polarity as marked on the relay coils, insure the relay is fully picked up to the stop.
3. Slowly decrease the applied voltage until the point where the armature drops away. Record this voltage and current as the "release" value.
4. Disconnect the test set for 1 second to allow the coil to fully de-energize. Reconnect the test set.
5. Slowly increase the voltage until the front contacts on the relay just close. Record this voltage and current as the "pick-up" value.
6. Continue to increase voltage until the relay armature moves up against the stop pin. Record this voltage and current as "work" value.
7. Insure that the values are within the allowances for that particular relay.
8. Carefully replace plug relay back into the rack avoiding damage to fingers and contacts. Replace coil wires to shelf type relay, ensuring proper polarity.

D.C. Biased Neutral Relays Test Procedure:

1. Follow procedure for testing D.C. Neutral relays.
2. When decreasing voltage, relay must be observed for minimum drop-away and full drop-

away in accordance with manufacturers' instructions. Both values shall be recorded.

3. Before returning the relay to service, reverse the energy to the coils of the relay. Relay must remain in the fully de-energized position.

TEST 4B

Frequency:

At least once every two years.

a. Test alternating current vane type relays, direct current polar type relays, magnetic stick, and relays with soft iron magnetic structures.

b. Test searchlight signal mechanisms.

c. Field tests on magnets (exclusive of forced drop type of electric locks), slot coils and coded carrier control equipment.

D.C. Polar Relays Test Procedure:

1. Open the wires to the relay operating coils or pull plug-in relay from the rack. Apply test set with leads reversed from present position.
2. Gradually apply voltage to the coils of the polar relay from zero until the polar armature reverses. Record this value as "Polar Reverse" or "Polar Normal."
3. Increase the voltage to service working voltage, then decrease to zero. Relay must remain in its last position.
4. Open the circuit for one second and change the polarity of the test set.
5. Gradually apply voltage to the coils of the polar relay from zero until the polar armature returns to normal. Record this value as "Polar Normal" or "Polar Reverse."

6. Increase the voltage to service working voltage, then decrease to zero. Relay must remain in its last position.
7. For polar relays with neutral contacts, test neutrals as per test 4A Parts 5 and 6. Observe that polar contacts reverse before neutral contacts pick up.
8. Insure that all values are within the allowances for that particular relay.
9. Carefully replace plug relay back into the rack avoiding damage to fingers and contacts. Replace coil wires to shelf type relay, ensuring proper polarity.

A.C. Single Element, Vane Type Relays Test Procedure:

1. Disconnect control wires from relay operating windings. Apply relay test equipment.
2. Apply an initial charge of energy to the winding of the relay with the usual polarity. Insure the relay is picked fully up to stop.
3. Slowly decrease the applied voltage until the point where the front contacts just open. Record this value as "Release".
4. Disconnect the test equipment for 1 second to allow the windings to fully de-energize. Reconnect the test equipment.
5. Slowly increase the voltage until the front contacts on the relay just close. Record this value as "Pick-up".
6. Continue to increase the voltage until the relay armature moves up to the stop position. Record this value as "Working".
7. Insure that the vane moves freely without binding or sticking. Observe that there is a

uniform clearance between each side of the vane and the pole faces.

8. Insure that the values are within tolerances for that particular relay.
9. Carefully replace plug relay back into the rack avoiding damage to fingers and contacts. Replace coil wires to shelf type relay, ensuring proper polarity.

A.C. Two Element, Vane Type Relays Test Procedure:

1. Disconnect line control wires from the operating windings, leaving the local control wires intact. Apply relay test equipment.
2. Apply an initial charge of energy to the winding of the relay with the polarity normal. Insure that the relay is fully picked up on the normal contacts.
3. Slowly decrease the applied voltage until the point where the normal contacts open. Record this value as "Normal Drop-away".
4. Disconnect the test equipment for one second to allow the winding to fully de-energize. Reconnect the test equipment.
5. Gradually increase the voltage to the relay until the normal contacts just close. Record this value as "Polar Normal".
6. Continue to increase the voltage until the armature moves up to the stop position. Record this value as "Working Normal".
7. Repeat steps 1 through 6 for the reverse position of the relay. Record all values.
8. Insure that the vane moves freely without binding or chafing. Observe that there is a uniform clearance between each side of the vane and the pole faces.

9. Insure that the values are within tolerances for that particular relay.
10. Replace control wires to return the relay to service.

TEST 4C

Frequency:

At least once every twelve months test centrifugal relays.

A.C. Centrifugal Type Relays Test Procedure:

1. Using existing track voltage, connect test equipment to control wires on track element of relay, inserting a variable resistor in series with one wire.
2. Apply an initial charge of energy to the track control of the relay. Insure that the relay is up to the stop.
3. Slowly decrease the voltage to the relay until the contacts in the relay just open. Record this value as "Drop-away".
4. Disconnect the test equipment for one second to allow the windings to fully de-energize. Reconnect the test equipment.
5. With the maximum resistance in the circuit, slowly increase the voltage to the windings of the relay until the front contacts just close. Record this value as "Pick-up".
6. Continue to increase the voltage to the relay until the armature comes up to the stop. Record this value as "Working".
7. Insure that the values are within the tolerances for that particular relay.
8. Return the control wires to the terminals of the relay with reversed polarity. Insure that the relay does not spin backwards and is held in

place by the pawl engaging the ratchet on the rotor.

9. Return the relay to service by replacing the control wires to their proper terminals and insuring that the spins with enough velocity to bring the armature up to the stop.

Test 4D

Frequency:
At least once every 4-years.

Vital Electronic Relay Devices

1. Gradually increase voltage so that device turns on at its manufacture specification "must operate value"

2. Gradually decrease voltage from the "Must operate value" until the device turns off at its manufactures specification "must operate value"

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.380

Purpose:

Test is to insure that signal levers of power and electro-mechanical interlocking machines and the latches of mechanical signal levers cannot be placed in normal position until

1. Corresponding control relays for light type signals are open,
2. Searchlight signals have assumed the red position,

At all relay and microprocessor interlocking, with relay contacts to facilitate opening RGP circuit.

1. That the route cannot be released,
2. RGPR and ASR are down, interlocking traffic remains locked,
3. Control machine does not indicate signal at stop,
4. And all switches, movable point frogs and derails remain locked, until all signal control relays associated with each signal are de-energized.

Note: At Microprocessor controlled Interlocking with Lamp Driver Board control of signal aspects, and without relay contacts to open RGP circuits, it will be sufficient to: Clear Home signal, and check that all switches, movable point frogs, derails, and any other appliances (such as a drawbridge) in the route are properly lined, and locked. Test all routes.

Responsibility:

Foreman C&S, Inspector C&S, Assistant Inspector Test, or Signal Inspector.

Records:
Results of Test 7, are to be recorded on Form C&S-27. All forms must be forwarded to the office of the Supervisor C&S.

Results:
If any discrepancies are found during testing the Foreman shall immediately notify the Supervisor C&S, and arrangements made for the safe protection of trains.

NOTE: Tests 7 and 8 or Tests 7 and 9 (as applicable) should be done together for each route.

TEST 7
ALL LIGHT TYPE SIGNALS INCLUDING SEARCHLIGHTS

Frequency:
At least once every two years or if circuits or devices are changed or disarranged.

Procedure:

1. Clear home signal by reversing lever or initiating request.

   Check that all switches, movable point frogs, derails, and any other appliances (such as a drawbridge) in the route are properly lined and locked, that corresponding RGPR and ASR relays are down, and that all switch (and other appliances) lock indication lights in the routes are properly displayed.

2. Place signal in stop position by returning lever to normal or initiating stop or cancel request.

   Check that all appliances listed in Paragraph 1 remain locked, that corresponding RGPR

picks up, that ASR relay remains down until time expires (see Test 8 or 9), that signal lever equipped with electric lock cannot be returned to full normal position until time expires, and that all applicable lock indication lights remain displayed.

3. Upon initial installation or when modified or disarranged, open (break) each signal control relay contact in RGP circuit on the side from which battery is feeding. Where searchlight signal heads are controlled, open RGP circuit at each signal head on battery side.

   For the periodic two year test, if the circuit has not been modified or disarranged, it will be sufficient to open (break) the battery at the beginning of the RGP circuit only **for <u>All</u> routes.**

4. Check (for each break in Paragraph 3) that all switches, movable point frogs and derails, traffic and any other appliances (such as a drawbridge) in the route are locked or that signal lever equipped with electric lock cannot be returned to full normal position after having been reversed. At all-relay or microprocessor interlockings it will be permissible to observe that corresponding RGPR and ASR relays are down and that all switch indication (and other appliances) lock indication lights in the route are displayed after positively establishing that each switch and other appliance is effectively locked during Paragraph 1 and 2.

5. Close (restore) RGP circuit, and then observe RGPR picks up. Open or shunt track relays progressively to allow ASR to pick up. Where levers are mechanically or electrically locked, check that signal lever is released to full normal position and/or that switches in route are released after each break. At all re-

lay or microprocessor interlockings, observe that all switch (or other appliance) lock indication lights show switches (and other appliances) released after each break.

6. Upon installation or any revision, check that the RGP circuit is open when any aspect other than Stop is displayed on the home signal.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.377

Purpose:
To insure 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.

Responsibility:
Foreman C&S, Inspector C&S, Assistant Inspector Test, and Signal Inspector.

Records:
Results of Test (8)-are to be recorded on C&S-27. All forms must be forwarded to the office of the Supervisor C&S.

Results:
If any discrepancies are found during testing the Foreman shall immediately notify the Supervisor C&S, and arrangements made for the safe protection of trains.

TEST 8
APPROACH LOCKING

Frequency:
At least once every two years or if circuits are changed or disarranged.

Procedure:
Check Approach Locking As Follows:

1. Check that approach relay is open when each track circuit in the approach is shunted.
2. Clear home signal.
3. Open approach relay.

4. Restore signal to normal position or place lever against the lock where lever is so equipped.
5. Check that all switches, movable point frogs and derails in the route are locked. After specified time has expired, check that locking is released.
6. Close approach relay.

Note: Test No. 8, and 7 should be completed together for each route.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.378

Purpose:
To insure that a 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.

Responsibility:
Foreman C&S, Inspector C&S, Assistant Inspector Test, Signal Inspector.

Records:
Results of Test 9are to be recorded on Form C&S-27. All forms must be forwarded to the office of the Supervisor C&S.

Results:
If any discrepancies are found during testing the Foreman shall immediately notify the Supervisor C&S, and arrangements made for the safe protection of trains.

TEST 9
TIME LOCKING

Frequency:
At least once every two years or when time locking circuits are changed or disarranged.

Procedure:

1. Clear the signal over the route to be tested.
2. Restore the signal to stop. Insure that the timing relay or device acting as a timing relay is operating.
3. Lever should not restore past indicating position. Switches, moveable point frogs, derails,

and bridges within route should remain locked, and no conflicting or opposing signals shall be able to be displayed.

4. Insure all track circuits are energized.
5. Insure that all switches, moveable point frogs derails and bridges in the route remain locked and that no conflicting or opposing signals may be cleared until after the predetermined time has expired.
6. Insure route releases after time has run down.
7. Repeat for all time locked signals in the interlocking.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.109, 234.265

Purpose:
To insure that safety is not compromised due to improper timing delay.

Responsibility:
Assistant Inspector Test, Maintainer C&S Test, Maintainer C&S, or Electronic Technician.

Records:
Results of Test 10 shall be recorded for all Time Releases, Timing Relays and Devices on Form C&S-27, showing the time on the plan or device and the actual time found in the field.

Results:
Any relay or device with a time less than 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.

TEST 10
TIME RELEASES, TIMING RELAYS AND TIMING DEVICES

Frequency:
At least once each year.

Inspection Procedure:

1. Insure that time interval for timing device is shown on the circuit plan and marked on the device itself.
2. Inspect that the seals for timing devices are intact and have not been tampered with.

3. Record the time and insure that it is not less than, nor 10% more than the time shown on the circuit plans.

A. Test Procedure - Time Releases

1. Wind-up time release approximately half way, let time run down and insure locking does not release.
2. Wind-up time release all the way, release the device, measure the time until the locking releases.

B. 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.
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.
4. For electronic timing relays with LED digital readouts, use an independent timing device to verify the accuracy of the LED readout.

C. Timing Devices

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

   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. At Microprocessor controlled Interlocking with internal timing device, it will be sufficient to observe control panel track indication lights to determine time interval.

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.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.380, 236.383, 236.386, 236.314

Purpose:

TEST 11A – Indication Locking

Test is to insure that no signal may be given over a switch, moveable point frog, or derail which has failed to operate to the corresponding position of its controlling lever or device.

TEST 11B – Restoring Feature

Test is to insure that the slide bar in an electro-pneumatic switch will return to its full normal or full reverse position before the locking dogs withdraw from the lock rods and the indication contacts open.

TEST 11C – Valve Locks, Valve Magnets, Etc.

Test is to determine that switch valves are in satisfactory condition with no leaks existing due to worn or cracked gaskets or valve seats.

TEST 11D – Electric Lock on H.O. Switch

Test is to insure that electric locks operate as intended.

TEST 11E – Switch Indication – Switch Control Correspondence

Test is to determine that switch control circuits must be in correspondence for switch to properly indicate.

Responsibility:

Maintainer C&S.

Records:

Results of Test 11 are to be recorded on Form C&S-27. All forms must be forwarded to the office of the Supervisor C&S.

Results:

If any discrepancies are found during testing the Maintainer shall immediately notify the Supervisor

C&S, and arrangements made for the safe protection of trains.

TEST 11A
SWITCH INDICATION

Frequency:

At least once each year.

Procedure:

Switch Indication - Point Detection Correspondence;

1. Place a 1/2" obstruction in the reverse switch point and operate the switch against the obstruction. Insure that the relay being used for reverse switch correspondence is de-energized or the controlling lever cannot be placed in the reverse position.
2. Attempt to clear a signal over that route.
3. Repeat steps 1 and 2 for the normal point.

NOTE: After proving that signals cannot be cleared over a de-energized switch correspondence relay, maintainer need only to observe correspondence relay for remainder of test.

4. For switches with mid-point helper movements, or circuit controllers, after completing steps 1, 2 and 3 above, place a 5/8" obstruction in the reverse mid-point between the point and the stock rail at the point detector rod and operate the switch under power. Observe that correspondence relay is de-energized. Repeat for each switch machine. Duplicate the test for the normal point.
5. For switches with more than two points, each point must be tested in a like manner.

TEST 11B
RESTORING FEATURE ON POWER SWITCHES

Frequency:

At least once every three months.

Procedure:

1. Electro-pneumatic machines
   a. Attach voltmeter to indication contacts in the switch circuit controller to monitor contact operation.
   b. Close globe or other type of valve which supplies air to the CP valves.
   c. Using a bar, move the slide bar of the switch toward the opposite position to a point just before the contacts open and the switch unlocks. (You may hear the air in the CP valve reservoir discharge into the cylinder)
   d. Insure indication contacts in switch circuit controller remain closed.
   e. Restore the air to the valves. Switch should return to its original position.
   f. Repeat test for reverse position of switch

2. Electric Machines
   a. Attach voltmeter to leaving side of indication contacts in the switch circuit controller to monitor contact operation.
   b. Remove fuse or open motor circuit.
   c. Crank switch movement to opposite position, insure that motor control contacts close before switch indication contacts

open. Replace fuse or close motor control contacts. Insure switch restores to its original position.

NOTE: Test 11B is not required on electric switches where power to motor is removed when lock relay is de-energized.

TEST 11C
VALVE LOCKS, VALVES AND VALVE MAGNETS

Frequency:

At least once every three months

Inspection Procedure:

1. Inspect the condition of the CP valve cover to insure that it fits properly and is secure when the hasp is in the locking position.
2. Remove the CP valve cover and inspect the wiring to the vertical terminal board. Wires should be properly tagged. Wire eyes should not be corroded or "pin-pointed". Notice any air leaks with the switch at rest and either correct them or make arrangements to correct them.
3. Remove the cover to the "walking beam" and insure that the contacts of the circuit controller are clean and bright. Contacts must not be covered with any oil or grease. Insure that the ribbons for the contact connections are in good condition and secured to the contacts. Air gap on open contacts must not be less than 1/16".
4. Remove the caps from the valve magnets. Be sure to keep each valve cap with its respective valve magnet. Mixing caps and valve magnets could lead to improper operation of the valve. Inspect each armature and magnet

head for dirt and moisture. Inspect magnet head springs, checking to see that the armature lays on each spring evenly. Armature stems should not be interchanged as each is adjusted to its particular seat and stroke. Changing armature stems may lead to improper operation.

5. With the normal magnet energized, hold down the lock magnet. Listen and observe for air leaks in the exhaust port on the valves, in the hoses feeding the cylinder and in the gaskets and packings in the switch cylinder. Repeat with the reverse magnet energized.
6. Turn off the globe valve or the valve that is feeding air to the switch valve and inspect the filter screen inside the valve reservoir for sediment and effluent.
7. Remove the cylinder caps to expose the packings on the shifting pistons. Remove the shifting pistons and inspect the packings looking for cracks and wear. Insure that the packings are adequately lubricated. Replace the shifting piston in the same cylinder it came from, as changing these can cause improper operation.

Test Procedure:

1. With the switch in the normal position and the normal magnet energized, hold down the lock and reverse armatures for about one minute, switch should not move or attempt to unlock from its lock rods.
2. While holding down the armatures of the lock and reverse magnets, insure that the "walking beam" of the circuit controller opens the switch indication circuit by attempting to center.

3. Repeat for the reverse position, holding down the lock and normal magnet armatures while the reverse magnet is energized for about one minute, switch should not move or attempt to unlock from its lock rods.
4. While holding down the armatures of the lock and normal magnets, insure that the "walking beam" of the circuit controller opens the switch indication circuit by attempting to center.

TEST 11D
ELECTRIC LOCKS ON HAND OPERATED SWITCHES

Frequency:

For switches without local time release feature, at least once every two years.

For switches with local time release feature, at least once every year.

Procedure:

1. Switches with local time release feature:
   a. Carefully inspect the electric lock for missing or worn parts that might render the electric lock ineffective.
   b. Insure that all wires are properly tagged and clear of all moving parts.
   c. Move the handle of the Model 9N lock or remove the padlock from SL-25, SL-26, Model 10 or Model 9L to initiate start of time interval.
   d. While time is running, attempt to display a signal from both adjacent interlockings toward the switch being tested. Signals must not be able to clear.

e. While time is running, attempt to display Clear to Next Interlocking Signal from both adjacent interlockings. Signal must not clear.

Note: New England Division (Cab No Wayside) territory some electric lock switch circuits are designed to facilitate long track blocks. Electric lock switch can be opened with Home signal governing entry into block displayed. Circuitry is designed to cut off cab signal code at sufficient braking distance, to ensure that train can come to safe Stop, if switch is unlocked, switch points are open, or the switch points are reverse. Refer to local circuit drawings when making test.

f. Insure that the operating handle for the hand-operated switch cannot be moved past the electric lock restraint.

g. After specified time interval has expired, check that lock is unlocked.

h. Attempt to display a signal from both adjacent interlockings toward the switch being tested. Signals must not be able to clear.

2. Switches without local time release feature:

a. Display signal from adjacent interlocking toward switch being tested. Check to insure that electric lock will not release.

b. Return signal to stop and allow time to run. Upon expiration of signal indication lock time, see that electric lock releases and switch can be operated.

c. Attempt to display signal from both adjacent interlocking toward switch while it is unlocked. Check to insure that signal cannot be displayed.

d. Attempt to display Clear to Next Interlock -ing Signal “C” from both adjacent Inter lockings. Signal must not clear.

3. Inspect electric lock for missing and worn parts, which might render the lock ineffective. Record inspection for all electric locks other than GRS Model 10.

4. Additional Procedure for GRS Model 10: (to be performed at least once every year)
   a. Place the switch lock in the locked position with a padlock in place.
   b. Pull up on the “Depress to Apply Padlock” pedal.
   c. The “Depress to Apply Padlock” pedal pawl should prevent the switch machine throw rod from being removed from the machine lock by a minimum of 1/8” with the switch stand operating lever driven toward the shimmed side of its opening.
   d. If the pedal pawl restraint is less than 1/8”, then the worn mechanical parts of the switch lock should be replaced.
   e. There should be no more than 1/8” total clearance between the sides of the operating lever and the sides of the switch lock. Add shims, if necessary, to reduce clearance to 1/8”.

TEST 11E
SWITCH INDICATION – SWITCH CONTROL CORRESPONDENCE

Frequency:

Test to be performed for new installations or when circuits or switches are disarranged.

1. Switch Indication - Switch Control Correspondence:

   a. Open control circuit to the controlling switch relays (WR) or devices (SML-110 Lock Circuit, CP Valves, “F” Controllers) so they will not respond. Attempt to throw the switch reverse, switch should not indicate.

   b. Close control circuits, (With SML-110 Controllers, control circuit must be closed, and the switch requested reverse) switch must indicate reverse. Re-open control circuit.

   c. Attempt to throw switch normal, switch should not indicate.

   d. Close control circuits, (With SML-110 controller, control circuit must be closed, and the switch requested normal) switch must indicate normal.

2. Switch Indication - Switch Machine Correspondence;

   a. Electric Switches

      1) Open the motor circuit on a switch machine and attempt to throw the switch reverse. Switch should not indicate.
      2) Close the motor circuit. (With SML-110, it will be necessary to re-request the switch reverse) Switch must indicate reverse.
      3) Re-open the motor circuit.
      4) Attempt to throw the switch back normal. Switch should not indicate.
      5) Close the motor circuit,(With SML-110, it will be necessary to re-request the switch normal) switch must indicate normal.
      6) Repeat steps 1 through 5 for each switch machine in the layout.

NOTE: Some switch machines break the indication circuits through the motor cut-out contact. Take precautions that this does not interfere with testing.

b. Electro-pneumatic Switches

1) Pull the valve stem on the lock magnet on the near end CP valve. Attempt to throw the switch reverse. Switch must not indicate.
2) Replace the valve stem. Switch must indicate reverse. Pull the valve stem on the lock magnet again.
3) Attempt to throw the switch normal. Switch must not indicate.
4) Replace valve stem. Switch must indicate normal.
5) Repeat steps 1 through 4 for each CP valve in switch layout.
6) To test walking beam correspondence, close the globe valve on the CP valves and remove the plug on the reverse end of the cylinder. Attempt to reverse the switch. Switch must not indicate.
7) Replace the cylinder plug and open the globe valve. Switch must indicate reverse.
8) Again close the globe valve and remove the normal side cylinder plug. Attempt to throw the switch normal. Switch must not indicate.
9) Replace the cylinder plug and open the globe valve. Switch must indicate normal.
10) Repeat steps 6 through 9 for each CP valve in switch layout.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.327, 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 ¼" by lock rods.

Responsibility:
Maintainer C&S

Records:
Results of Test 13 shall be recorded for all switch points on "Joint Switch And Frog Inspection And Test Report", and forwarded to the office of the Supervisor C&S.

Results:
If any discrepancies are found during testing, the maintainer shall immediately make the proper adjustments to insure the switch passes the test. Any lock rod that is found to be out of the scope of AMT - 23, Para. 402 , shall be immediately replaced. If repairs or adjustments cannot be made immediately, the Supervisor C&S must be informed and arrangements made for the safe protection of trains.

TEST 13

SWITCH OBSTRUCTION

Frequency:
At least once every month or if any part of the switch layout that affects switch locking is modified or disarranged.

Inspection Procedure:

1. Inspect the general condition of switch layout which may affect reliability and safety, such as surfacing, ties, braces, rods, points, stock rails, nuts, bolts and cotter pins.

2. Inspect general condition of switch machine which may affect reliability and safety including:
   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 throw 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" 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.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.387, 236.312

Purpose:
Test is to insure that no signal can be displayed over a moveable bridge unless the bridge is properly aligned and locked in accordance with FRA 236.312.

Responsibility:
TEST 14A - Maintainer C&S
TEST 14B - Maintainer C&S
TEST 14C&D - Maintainer C&S jointly with Foreman C&S, Inspector C&S, Assistant Inspector Test, Maintainer C&S Test or Signal Inspector.

Records:
Results of Test 14 shall be recorded on Form C&S-27.

Results:
If any device or apparatus does not meet the criteria of this test, it shall immediately be adjusted or replaced and action must be taken for the safe protection of trains.

TEST 14A

RAIL SEATING CONTROLLER (COUNTERWEIGHT OR SPRING) OR MECHANICAL RAIL LOCK.

Frequency:
At least once every month.

Procedure:
Test each lift rail with 3/8 inch obstruction. Rail seating controller or proximity detector should not indicate seating, or rail lock should foul.

TEST 14B

OPERATION OF CIRCUIT CONTROLLERS, ELECTRIC LOCKS, GROUND LEVER LOCKING.

Frequency:

At least once every month. (Once every three months for bridges not equipped for automatic operation)

Procedure:

1. Check operation of all circuit controllers connected to the wedges, latches, rail locks, etc., to see that contacts make or break when corresponding functions are in their proper position.
2. Verify proper operation of correspondence relay.
3. Inspect mechanical wedge lock and controllers.
4. Check bolt locks and electric locks to insure that levers are not released for operation until all functions involved are in proper position.

TEST 14C

ADJUSTMENT OF LOCKS, LOCKING AND CIRCUIT CONTROLLERS

Frequency:

At least once every three months for bridges equipped for automatic operation.

At least once a year for bridges not equipped for automatic operation.

Procedure:

1 In addition to Test 14A and 14B of this test, check adjustment of each mechanical wedge or lock; wedge or lock shall fail if it is not within one inch of full driven position.

2 Check locking between mechanical ground levers.

3 Check adjustment of all circuit controllers in accordance with the following table.

Test 14D
Lift Rails, Wedges, and Bridge Lock Circuitry

Frequency:
All bridges at least once each year, or if circuits or devices are changed, or disarranged.

Procedure:

1. Open control circuit to lift rail normal repeating relay, and attempt to clear signal for track under test. Insure that signals governing movements over bridge cannot display an aspect to proceed.
2. Open control circuit to Wedge / Bridge Lock repeating relay, and attempt to clear signal for track under test. Insure that signals governing movements over bridge cannot display an aspect to proceed.

Note: Bridges not equipped with operating Miter rails are to be tested in accordance with Test 14B, C, & D at least once each year.

Table 14-1.
Moveable Bridges Closing Conditions

DEVICE	POSITION TO BE INDICATED	CONTACT CLOSURE CONDITIONS (TO BE OPEN UNDER ALL OTHER CONDITIONS)
Surfacing Wedges Bridge Locks	Fully Driven	Fully driven to within one inch of fully driven. (To be open when wedge or bridge lock is one inch or more from fully driven)
	Withdrawn*	Fully withdrawn to two inches from fully driven.
	Fully Withdrawn **	Fully withdrawn to within one inch of fully withdrawn.
Lift Rails	Fully Seated (lowered)	Lift rail fully seated to within 3/8 inch of fully seated. (To be open with full 3/8 inch obstruction)
	Raised*	Fully raised to one inch from fully seated.
	Fully Raised**	Fully raised to within ½ inch of fully raised. (Contact closure at ¼ inch)

* If this check is made in C&S equipment for “cycle-check” only

** If this check is made in C&S equipment to insure that wedges, bridge locks or lift rails are clear to permit moving the bridge.

Table 14-1.
Moveable Bridges Closing Conditions (cont'd)

DEVICE	POSITION TO BE INDICATED	CONTACT CLOSURE CONDITIONS (TO BE OPEN UNDER ALL CONDITIONS)
Rail Locks	Locked	Through rail seat casting at least full thickness.
	Unlocked	Clear rail seating one inch or more.
Latches	Raised	Fully raised to within one inch of fully raised.
	Dropped	Fully seated to within one inch of fully seated.
Bridge Couplers	Driven	Fully driven to within one inch of fully driven.
	Withdrawn	Fully withdrawn to within one inch of fully withdrawn.

Table 14-1.
Moveable Bridges Closing Conditions (cont'd)

DEVICE	POSITION TO BE INDICATED	CONTACT CLOSURE CONDITIONS (TO BE OPEN UNDER ALL CONDITIONS)
Trolley Contact Bridges	Open	Fully open to within ¾ inch of fully open.
	Closed	Fully closed to within ¾ inch of fully closed.
Dead Weight Rollers	Each Position	As near end of stroke as possible. Weight of bridge must be off rollers before contacts make.
Bridge Seating Controller	Bridge Seated	Bridge fully seated to within 3/8 inch of fully seated (Contact closure at ¼ inch)

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.379, 236-381

Purpose:
To ensure the route remains locked in advance of a train that has accepted a signal to proceed into that route, and that switches remain locked under the train.

Responsibility:
Maintainer C&S. On new installations or changes Foreman C&S, Inspector C&S, Assistant Inspector Test, Maintainer C&S Test or Signal Inspector.

Records:
Results of Test 15 Route Locking are to be recorded on Form C&S-27, showing track circuits shunted and switches locked. All forms must be forwarded to the office of the Supervisor C&S.

Results:
If any discrepancies are found during testing the maintainer shall immediately notify the Supervisor C&S and make arrangements for the safe protection of trains.

TEST 15A
ROUTE LOCKING

Frequency:
At least once every two years, and on new installations or when subsequent changes to existing installations are made.

Procedure:

1. Line the route to be tested.
2. Clear the home signal for the route to be tested.

3. Open the first track circuit in route.
4. Cancel signal request, or restore signal lever to normal (or normal indicating position if lever movement is restricted).
5. Check that time or approach locking has released (and place signal lever in full normal position). At interlocking where two track circuit release is in use, it will be necessary to momentarily shunt the second track circuit in the route to release the time or approach locking.
6. After approach or time locking has released, check that all switches, movable point frogs, derails, and other appurtenances in the route are locked. Where Rule 261 is in effect, check that traffic direction cannot be changed or opposing home signal at next interlocking cannot be changed from displaying “Stop Signal”.
7. Close track circuit.
8. Each route must be tested. Where Rule 261 is in effect, that portion of Test 15.A.6 concerning traffic direction change or opposing home signal at next interlocking only needs to be tested once for each track.

NOTE: In all-relay interlockings, where two or more signals governing movements in one direction have a common track circuit in advance of such signals, all routes must be checked for one of these signals and only one route needs to be checked for each of remaining signals in that group. All possible routes from each signal must be checked where vital microprocessor logic is used.

TEST 15B
ROUTE LOCKING ON NEW INSTALLATIONS OR WHEN SUBSEQUENT CHANGES TO EXISTING INSTALLATIONS ARE MADE.

Frequency:

On new installations or when any part of the route locking function is modified or disarranged.

Procedure:

1. Line the route to be tested.
2. Clear the home signal for the route to be tested.
3. Shunt the first track circuit in the route.
4. Cancel the signal request, or restore the signal lever to normal (or normal indicating position if lever movement is restricted).
5. Check that time or approach locking has been released (and place signal lever in full normal position). At interlockings where two track circuit release is in use, it will be necessary to momentarily shunt the second track circuit in the route to release the time or approach locking.
6. After approach or time locking has released, check that all switches, moveable point frogs and derails in the route are locked. Where rule 261 is in effect, check that traffic direction cannot be changed or opposing home signal at next interlocking cannot be changed from displaying “Stop Signal”.
7. Shunt the second track circuit in the route, then remove the first shunt. Allow time for the track repeater in the first circuit to energize. Insure that all switches, movable point frogs, and derails in the occupied circuit and in advance of the occupied circuit remain locked.

For interlockings with sectional release, test switches, movable point frogs and derails to insure that they unlock when the shunt to the rear is lifted.

8. Repeat step 7 until track circuits within the route have been shunted and released.
9. Perform test for the same route in the opposite direction.
10. Insure that each route in the interlocking is tested as described above, in each direction.
11. Check the location of all fouling points and route locking release points for crossovers and turnouts for adequate clearance in accordance with Standard Plan SP803.

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.

In placing all relay, or microprocessor controlled interlocking in service, test 15B, and 16C can be performed simultaneously.

Test 15C
Switch Detector Locking
Test is to ensure that switch detector locking operates as intended, when, track circuit over switch is occupied by Train, Engine, or Car.

Frequency: At least once every two years, or if circuits or devices are changed or disarranged.

Procedure:

1. Ensure the signal governing the route over the switch is in the STOP position, and the switch is in the normal position.

2. Open track repeater circuit where switch points are located.

3. Verify that track circuit is de-energized by observing the track repeater indication lights on the model board, or control machine.

4. Ensure switch lock indication light, and normal switch indication lights are illuminated on the local control panel at all-relay or microprocessor interlocking.

5. Ensure switch lever is locked on electro-mechanical type interlocking machine by attempting to move lever to the reverse position. Lever should not unlock.

6. Attempt to operate the switch to the reverse position. Ensure that switch points do not physically move.

7. Close track repeater circuit, and throw switch to the reverse position.

8. Open track repeater circuit where switch points are located.

9. Verify that track circuit is de-energized by observing the track repeater indication lights on the model board, or control machine.

10. Ensure switch lock indication light, and reverse switch indication lights are illuminated on the local control panel at all-relay, or microprocessor interlocking.

11. Ensure switch lever is locked on the electro-mechanical type,interlocking machine by attempting to move lever to the normal position. Lever should not unlock.

12. Attempt to operate the switch to the normal position. Ensure that switch points do not physically move.

Note: Track repeater circuits must be verified by shunting track circuits on new installations, or when track repeater function is modified, or disarranged.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.381

Purpose:
Test is to insure that once a signal has been cleared into a section of track, or a train has entered a section of track, the direction of traffic cannot be changed nor can opposing signals be cleared into that section.

Responsibility:
Maintainer C&S. On new installations or changes Foreman C&S, Inspector C&S, Assistant Inspector Test, Maintainer C&S Test or Signal Inspector.

Records:
Results of Test 16 Traffic Locking are to be recorded on Form C&S-27, showing track circuits shunted and switches locked. All forms must be forwarded to the office of the Supervisor C&S.

Results:
If any discrepancies are found during testing the maintainer shall immediately notify the Supervisor C&S and make arrangements for the safe protection of trains.

TEST 16A

CHECK TRAFFIC LEVER TYPE TRAFFIC LOCKING.

Frequency:
At least once every two years.

Procedure:
(This test applies only to traffic locking established through manipulation of traffic levers which are equipped with electric locks.)

1. Establish a traffic direction.
2. Clear signal governing movement into that track section.
3. Check that direction of traffic cannot be changed.
4. Open first track circuit in route.
5. Restore signal lever to full normal position.
6. After approach of time locking has released, check that direction of traffic cannot be changed.
7. Close the track circuit.
8. Repeat test with traffic established in the opposite direction.

TEST 16B

CHECK TRAFFIC LEVER TYPE TRAFFIC LOCKING.

Frequency:

When new installations are placed in service or when any portion is modified or disarranged

Procedure:

1. Test shall be made as in Test 16A above.
2. Shunt each track circuit progressively checking that traffic direction cannot be changed and that opposing signal cannot be displayed. Ensure care that the shunt on the next circuit in the route is established before releasing the shunt on the proceeding track circuit. Work progressively from initial signal to next interlocking where opposing signal is located.

3. Make the test on each track with traffic in each direction.

TEST 16C

TRAFFIC LOCKING FOR ALL RELAY OR MICROPROCESSOR INSTALLATIONS.

Frequency:

When new installations are placed in service or when any portion is modified or disarranged.

Procedure:

1. Clear signal on normal route, establishing traffic direction.
2. Check that opposing signal on normal route cannot be displayed, and that traffic direction cannot be changed.
3. Shunt each track circuit progressively, taking care that the shunt on the next circuit in the route is established before releasing the shunt on the preceding circuit, but insuring that preceding track circuit picks up before testing next circuit. Work progressively from initial signal to next interlocking where opposing signal is located.
4. Check that opposing signal cannot be displayed and that traffic cannot be changed for each individual track circuit shunted in Test 16C Part 3 with no other circuit shunted.

4a. Where Electronic track circuits (Electrocode and Genrakode) are in use between interlockings, observe the QT or HR relay at the exiting end of the block to ensure that it remains de-energized during successive shunting of track circuits.

5. Test from each interlocking signal leading to track being tested. After all track circuits in

normal route have been tested once to the opposing interlocking signal, other routes may be tested progressively from the entering signal to the first track circuit outside the initiating interlocking. While the first track circuit outside the interlocking is occupied on one of these passes, check that all opposing interlocking signals are prevented from displaying other than “Stop Signal”.

6. Make complete test outlined in Test 16C Part 1 through Part 5 in the opposite direction.

NOTE: In placing modern all-relay or microprocessor interlockings in service, Test 15B and 16C can be performed simultaneously

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.102b

Purpose:
To insure that the spectacle arm holding the colored discs is free from obstructions and does not bind or catch.

Responsibility:
Assistant Inspector Test, Maintainer C&S Test or Signal Inspector and Maintainer C&S

Records:
Results of Test 17, Signal Mechanisms, are to be recorded on Form C&S-27. All forms must be forwarded to the office of the Supervisor C&S.

Results:
If any discrepancies are found during testing the maintainer shall immediately notify the Supervisor C&S and make arrangements for the safe protection of trains.

TEST 17
SIGNAL MECHANISMS

Frequency:
At least once every six months.

Inspection Procedure:

1. Visually inspect the mechanism for broken, corroded, burned or worn parts. Insure the glass base is securely fastened and no breakage or cracks are evident. Inspect the inside of the mechanism for foreign objects or evidence of corrosion on moving parts or pole faces.
2. Insure that the lens system is clean and intact.

3. Insure that all colored discs are securely fastened within the retaining rims of the spectacle arm and are free of cracks.

NOTE: The green disc in the searchlight mechanism is pre-cracked by the manufacturer to avoid uncontrolled breakage due to the heat of the lamp. If double cracks occur or white light is visible through the disc, the mechanism should be replaced immediately.

Test Procedure:

1. A "movement" test must be made to determine that the spectacle arm moves from red to green and from red to yellow and vice versa without sluggishness or without being hindered by obstructions.
2. Disconnect signal control wires from the mechanism.

NOTE: If using an external battery source to test the mechanism, then only one wire need be removed.

3. Remove the reflector unit. (The reflector unit houses the lamp.)
4. Apply normal voltage to the signal control wires, then abruptly remove the energy. The mechanism should settle to its most restrictive position smoothly, and spectacle arm should "rock" 2 or 3 times before settling. A distinctive click should be heard each time the spectacle passes center. If the spectacle is sluggish or doesn't "rock" to center then friction is indicated and the mechanism must be replaced.
5. Reverse the polarity of the applied voltage to the mechanism, then repeat step 4, above.
6. Replace the control wire(s), insuring proper polarity. Replace the reflector unit.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.107, 234.249

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

Records:
Report results of Test 18 on ground tests on form C&S-27 and summarize monthly, or in areas using Maximo, record results in the Maximo Database.

Results:
Grounds in excess of that expressed below must be eliminated at once. Any ground that cannot be located must be reported to the Supervisor C&S immediately.

TEST 18
GROUND TESTS

Frequency:

TEST 18 - At least once every 30 days for all locations. At locations that have been burned out by fire, lightning or traction, ground readings must be taken on all associated wires and apparatus immediately.

NOTE: This test is not required to be made on track circuit wires, AC distribution wires, or common return wires of grounded common single break circuits.

Test Procedure

1. Test is made by measuring voltage potential between each energy bus and ground. If a voltage potential between an energy bus and a ground is detected, a current reading shall be taken to determine whether a ground exist in excess of that permitted by this test.

2. Where ground meters are not provided, connect positive meter lead of voltmeter to a positive energy buss and connect the negative meter lead to a known ground. If voltage is read, there is an apparent negative ground. Make a similar test on the negative energy buss by connecting the negative meter lead to the negative buss and connect the positive lead to a known ground. If voltage is read, there is an apparent positive ground.

3. If voltage is detected, the amount of current flow to ground must be established by inserting an ammeter between the buss and ground to determine whether a true ground exists. When it is determined that a ground exists, use of an ammeter will facilitate location of same, and will provide a tolerance level. Care should be exercised in use of an ammeter in respect to the movement of trains and the integrity of the signal system; for applying an ammeter between battery and ground can be the second path that completes an undesired operation and/or indication.

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 BUSSES AND GROUNDS BE LEFT UNATTENDED.

4. When a current reading in excess of .025 Ampere (25 Ma) on high voltage battery (110 volts) or .001 Ampere (1 Ma) on low voltage battery is recorded, further tests must be executed to discover the location of the ground and eliminate it.
5. At locations with approach lighting, signals must be lit before testing.
6. At Highway grade crossings, D.C. power busses (excluding overlay battery) should be tested with the POR relay down and the crossing operating. This is to insure that all wiring is ground free. To test A.C. power busses, crossing need not be operating.

NOTE: Where a "battery bus" is energized only by the use of a rectifier, without including the physical battery, the taking of ground readings on such rectifier "battery bus" is to be included within the scope of this test.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.104

Purpose:
To insure the integrity of the fouling wires in a switch layout and to insure those wires will detect equipment in the foul of the main track. Also to insure the integrity of wires used to shunt track circuits in switches with heavy-duty shunt type circuit controllers.

Responsibility:
Maintainer C&S

Records:
Results of Test 19 on fouling circuits and shunt wires shall be recorded on Form C&S-27.

Results:
Any deficiencies noted shall be repaired or corrected immediately.

Inspection procedure:
Visually inspect fouling circuit to determine that all bonds and fouling wires are intact, visible, in good condition, and in place as per FRA Title 49 Parts 236.57, and 236.58.

TEST 19A
FOULING WIRES

Frequency:
At least once every three months.

Test Procedure:

1. Place a voltmeter across the main track rails, opposite the switch and check for track circuit voltage.

2. Place a .25-ohm shunt across the rails at a point within the fouling section farthest from the insulated joints. (See Figure 19-1, Shunt A)
3. Check the voltage on meter of the main track rails. Insure track relay is in the de-energized position.
4. Move the shunt as close as possible to the insulated joints within the fouling section and repeat. (Shunt B)
5. Move the shunt again on the main track side of the insulated joints and repeat. (Shunt C)

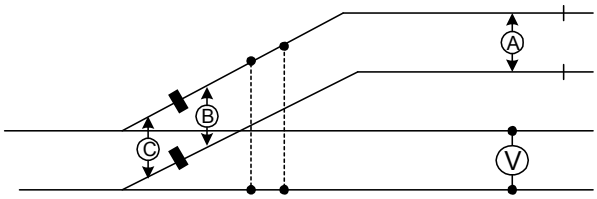


Figure 19-1.
Shunt Fouling Single Track Relay

6. For shunt fouling circuits within interlockings that have two track relays, perform test with shunt placement as shown in Figure19-2 and insure both track relays drop to their most restrictive position.
7. Visually inspect fouling wires to determine that all fouling wires are intact, visible, in place and in good condition.

NOTE: See table 24-1 of AMT 27, Test 24 to determine shunt value appropriate for track circuit being tested.

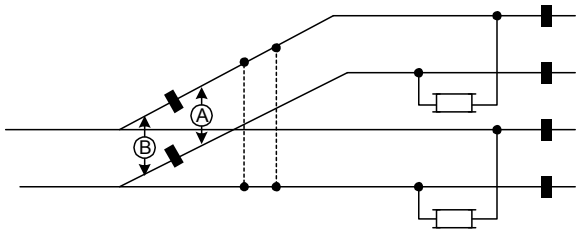


Figure 19-2.
Shunt Fouling Dual Track Relay

TEST19B
SWITCH SHUNT WIRES

Frequency:

At least once every three months.

Test Procedure:

1. Place voltmeter across from the switch and observe the track circuit voltage.
2. Trip the point detector.
3. Check the voltage on meter of the main track rails. Insure track relay is in the de-energized position.
4. Reset the point detector.

TEST 19C
SERIES FOULING WIRES

Frequency:

At least once every three months.

Test Procedure:

1. Visually inspect series fouling circuit to determine that all bonds and fouling wires are intact, visible, in place and in good condition.
2. Insure that the location of the cable is per the standard plan for that type of switch. (cables not properly aligned may result in a loss of cab signals).

NOTE: Shunt fouling wires, that are included as part of series fouling layout, must be tested per Test # 19A.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.103

Purpose:
To insure switch circuit controllers are in good condition and properly adjusted.

Responsibility:
Maintainer C&S

Records:
Results of Tests 20A, 20B, 20C, and 20D for point detectors shall be recorded on Form C&S-27. All forms must be sent to the office of the Supervisor C&S.

Results:
Any circuit controller or point detector not meeting the conditions of this test must be adjusted, repaired or replaced immediately.

TEST 20A

END POINTS (Applies to Power and Hand Operated Switch and Lock Movements)

Frequency:
At least once every three months.

Inspection Procedure (All Switches):

1. Inspect the general condition of the switch circuit controller, switch point detector, and all connecting rods. Insure that circuit controller connecting rods, lug and lug connections do not have lost motion and are properly lubricated.
2. Inspect all wires to insure they are properly tagged and clear of all moving parts. Insure that shunt wires, where used, consist of two conductors and are visible for inspection.

3. Contacts should be clean, bright and uniform. Open contact air gap must not be less than 1/16". Ribbons for contact connections must be in good shape.
4. Rollers and cams must not be worn, cracked or flat spotted. Adjusting screws should be in good condition and must not be stripped or worn. Linkage and roller pins must not be worn excessively and must be in proper position and fastened securely.
5. Inspect general condition of switch machine which may affect reliability and safety including:
   a. Proper lubrication of switch plates
   b. Inspect all switch housings for cracks, make sure gaskets are intact, hinges and latches are in good shape and all padlocks are intact.
6. Insure proper amount of point pressure
7. Check the condition of the lock rod to insure that the edges are square and the openings conform to safety standards.
8. Check locking dog or plunger to insure that the locking edges are square.

Switch End Points, Including Movable Point Frogs for Standard Turnouts #15, and Larger end points

Procedure:

1. Connect a voltmeter across the relay end of switch repeater circuits to determine if the switch controller is working as intended.
2. Test point detector with gages in accordance with manufacturers instruction pamphlet so that the switch will latchout with a 3/8” obstruction where mechanical latch out is

provided. If switch fails to latch out, point detector needs to be adjusted. Where mechanical latch out is not provided, switch indication contacts must be opened by a ¼" obstruction gage.

3. Confirm that switch indication contacts are open and voltmeter reads zero.
4. Remove the gage, close the switch, and insure that the switch repeater circuit closes.
5. Repeat steps 1 through 4 for all the points in the switch layout.

TEST 20B

MID-POINT CONNECTED CIRCUIT CONTROLLERS (Applies to Power Switch Machines or Midpoint Circuit Controllers)

Frequency:

At least once every three months

For 39, 45 foot points, and 26.5, 32.7 Mid-Point of Movable Swing Nose Frog Layout

Procedure:

1. Perform Test 20A Inspection Procedure part 1 through 8.
2. Inspect the mid-point of each switch point to insure that it is adjusted to fit solidly against the stock rail.
3. Connect a voltmeter across the relay end of switch repeater circuits to determine that the switch controller is working as intended.
4. If the mid-point is equipped with a circuit controller, insure that the switch indication circuit is opened when the mid-point has a 5/8" obstruction between the point and the stock rail at the point where the point detector rod connects to the circuit controller or at operating rod location. This step is not necessary where there is no mid-point circuit controller.
5. Switch indication circuit should indicate when the mid-point has a 1/2" obstruction between the point and the stock rail at the point where the point detector rod connects to the circuit controller, or at the operating rod location.

Note: Latch-out should be arranged to be Self-restoring.

For High Speed Asymmetrical Tangential Points Longer Than 45 Feet

Procedure:

1. Perform Test 20A inspection procedures Parts 1 through 8.
2. Inspect the mid-point of each switch point to insure that it is adjusted to fit solidly against the stock rail or that proper gauge is maintained.
3. Test point detector with gages in accordance with manufacturers instruction pamphlet so that the switch will latchout with a 3/8" obstruction. If switch fails to latch out, point detector needs to be adjusted.
4. Confirm that switch indication contacts are open.
5. Remove the gage, close the switch, and insure that the switch repeater circuit closes.
6. Repeat for reverse position.

Duplicate steps 1-6 for other mid-point switch machines.

Note: Includes both 2nd, & 3rd switch machines. Second (2) and third (3) machines should be arranged to be Self-restoring.

TEST 20C

H.O. SWITCH WITH CIRCUIT CONTROLLER WITHOUT POINT DETECTOR (Applies to Switch Stands with Circuit Controllers only)

Frequency:

At least once every three months

Procedure:

Circuit Controllers

1. Perform Test 20A inspection procedure Parts 1 through 6.
2. Connect a voltmeter across the rails where a shunt is used or across the relay end of switch repeater circuits to determine if the switch controller is working as intended.
3. Place a 1/4" obstruction gage 6" back from the point between the point and the stock rail.
4. Close the switch point against the gage.
5. Insure that:

   a. Track is shunted, or

   b. Signal control circuits are open, or

   c. Switch repeater circuit is open.
6. Remove the obstruction gage, close the switch, and insure track shunt is removed, signal control circuit closes or switch repeater circuit closes.
7. Repeat for reverse point if applicable.
8. If switch has another end, repeat test for other end.

TEST 20D

INTERLOCKING SWITCH CIRCUIT CONTROLLERS NOT EQUIPPED WITH POINT DETECTORS.

Frequency:

At least once every three months.

Procedure:

1. Perform Test 20A Inspection Procedure Parts 1 through 8.
2. Connect a voltmeter across the relay end of switch repeater circuits to determine that the switch controller is working as intended.
3. Place a 1/4" obstruction gage 6" back from the point between the point and the stock rail.
4. Close the switch point against the gage.
5. Insure that the switch repeater circuit is open
6. Remove the obstruction gage, close the switch, and insure that the switch repeater circuit closes.
7. Repeat for reverse point if applicable.
8. If switch has another end, repeat test for other end.

TEST 20E

STOP SCREW ADJUSTMENT OF POINT DETECTOR – MODEL A-5 SWITCH MACHINE

Frequency:

At least once every year.

Background:

Stop screws in the sub-base of the A-5 are adjusted at the time the machines are assembled to limit the strokes of the point detector cranks to a position where the circuit controller upper drive rollers clear the respective outer cam surfaces on the motion plate by 1/32 inch. After proper adjustment is obtained, the screws are cut off flush with the outside of the casting and prick punched. Refer to the Union Switch and Signal manual 5044.

The purpose of this test is to determine if the stop screws have worn to the point that they must be replaced.

For Machines With Spring Loaded Latch Stem Point Detector.

Procedure:

1. With the switch in the reverse position, latch out the point detector.
2. Push the latch stem down until it projects approximately 1/8 inch.
3. Using your fingers rotate contact drum in direction to re-close indication contacts. Do not use a tool to pry the contact drum. Point Detector on other arm should hit stop screw & indication contacts should remain open.
4. If the indication contacts can be closed, latch out the point detector and with the point detector in the full latched position, using your fingers, rotate the contact drum in the direction to re-close indication contacts. Point Detector on other arm should hit stop screw and indication contacts should remain open.
5. Repeat steps 1 through 3 with switch in Normal position.
6. If the indication can be closed in any of the steps above, the point detector circuit controller located at the head-end point must be readjusted so that the point detector will not indicate with a ¼" obstruction. Float the lock rods when readjusting the point detector to open with a ¼" obstruction in the point. This adjustment must be maintained until the machine is repaired or replaced. Mid-Point machines that fail test will be replaced as soon as practical.

7. Notify the Supervisor C&S or the Assistant Division Engineer C&S when the point detector is readjusted as per step 6.

For A-5 Machines With Drop Latch Point Detector.

Procedure:

1. With the switch in the reverse position, latch out the point detector.
2. Using your fingers rotate contact drum in direction to re-close indication contacts. Do not use a tool to pry the contact drum. Point Detector on other arm should hit stop screw & indication contacts should remain open.
3. Repeat steps 1 and 2 with the switch in the normal position.
4. If the indication can be closed in any of the steps above, the point detector circuit controller located at the head-end point must be readjusted so that the point detector will not indicate with a ¼" obstruction. Float the lock rods when readjusting the point detector to open with a ¼" obstruction in the point. This adjustment must be maintained until the machine is repaired or replaced. Mid-Point machines that fail test will be replaced as soon as practical.
5. Notify the Supervisor C&S or the Assistant Division Engineer C&S when the point detector is readjusted as per step 4.

NOTE: If the stop screws are worn and need replacement, this is an indication that other parts are also worn and the machine should be scheduled for a complete rebuild in the repair shop as soon as practical.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA, Docket No. H-96-1, and various approvals to modify the conditions of Docket No. H-96-1

Purpose:

Test 22A

To insure that the signal enforcement and highway crossing advance start subsystems of Incremental Train Control System (ITCS) function correctly upon new installation, extension, deletion, or modification of an ITCS system or any portion of the underlying signal system (including signaled track layout configuration changes) or any highway crossing warning system in ITCS territory.

Test 22B

To insure that ITCS functions correctly upon new ITCS installations or upon any modification or disarrangement of Server EPROM IC15 or IC17 containing the following server files:

1. Server Configuration
2. Table of Indications – Passenger
3. Table of Indications – Freight
4. Track Profile
5. Track Map
6. Civil Speed Restrictions (Permanent)
7. Table of Indications Label

Test 22C

To insure that ITCS correctly enforces temporary slow orders upon new ITCS installations or upon any modifications or disarrangement of the Office to Wayside Link (OWL) or of Server EPROM IC15 containing the Server file:

1. Server Configuration,

or Server EPROM IC17 affecting the following server files:

2. Table of Indications – Passenger
3. Table of Indications – Freight
4. Track Profile, or
5. Track Map,

or Server EPROM IC18 containing the following server files:

1. Temporary Slow Order – Passenger, and
2. Temporary Slow Order – Freight

Test 22D

To ensure correct ITCS operation, upon installation, or upon replacement of any ITCS component or module with an equivalent component or module.

Responsibility:

Test 22A, 22B, 22C, and 22D
Foreman C&S, Electronic Technician, Signal Inspector or Signal Maintainer

Records:

Results of Test 22A1 shall be recorded on special forms prepared for each signal location and Test 22A4 on special forms prepared for each highway crossing location. These forms shall be attached to Form C&S 27 that will list locations tested and the unique identification number of each form attached for each location tested. Results of Tests 22A2, 22A3, 22B, 22C, and 22D shall be recorded on Form C&S 27.

Results:

Any defects or discrepancies shall be noted on the test forms and corrected immediately. If defects or discrepancies cannot be immediately corrected, the Supervisor C&S must be notified and arrangements must be made to make the corrections as soon as possible.

TEST 22A
ITCS SIGNAL SYSTEM AND HIGHWAY CROSSING VERIFICATION

Frequency:
Before a new ITCS installation is placed in service or upon extension, deletion, or modification of any ITCS system or any portion of the underlying signal system (including any addition or deletions of signal aspects, turnouts or crossovers, or any track configuration change) or any highway crossing warning system in ITCS territory, or when there is any modification or disarrangement of non-server WIU EPROMS IC14 or IC15 or Server EPROM IC14, IC15 or IC17*****. (*****Exception: When the modification in Server EPROM IC17 is to the Permanent Civil Speed Restriction File Only and the ITCS system passes all parts of Test 22B, Test 22A need not be performed again)

Procedure:
ITCS Signal Enforcement Verification:
Upon installation or modification of any circuitry connecting ITCS equipment or logic with signal equipment or logic, these circuits must be thoroughly checked according to AMT 27, Tests 23A7 and 23B prior to performing the following tests:
1. For each signal aspect displayed by each signal monitored by ITCS, insure the following are in complete agreement:
a. 1. Display and observe each aspect on each fixed signal that has had an aspect (or aspects) added and/or deleted.
a. 2. If no aspect on any fixed signal has been added or deleted, changes in EPROM IC17 that might affect files 2 (TOI – Passenger) and 3 (TOI – Freight) may be tested by testing each aspect listed in each TOI, once in each server area. It will not be necessary to test every signal displaying the same aspect within that server area.

b. Verify by RBWT, TEFKAS or other approved means that Server Status Update messages to all trains approaching that signal indicates the same aspect as that displayed on the fixed signal.

c. Verify that the speed limits, target speeds and targets displayed on the On-Board CLD approaching each fixed signal aspect, and following acceptance of each aspect are correct for each fixed signal aspect tested. When RBWT is available, this verification may be performed without a test train.

2. For each switch monitored by ITCS, verify by RBWT, TEFKAS or other approved means that Normal and Reverse Switch Positions indicated in the server Status Update messages correctly correspond with the actual switch positions of the turnouts and crossovers they represent:

   a. In each interlocking, verify Normal and Reverse position status of each switch is correctly indicated in the server Status Update message.
   b. For each non-interlocked hand-operated switch, verify Normal and Reverse if applicable, position status of switch is correctly indicated in the Server Status Update message.

3. For each interlocking (“OS”) track circuit monitored by ITCS, verify that track occupancy status is correctly indicated in the Server Status Update message.

4. For each Highway Crossing Warning System:
   a. Verify that “High Speed OK”, “Advance Start Enable”, “Crossing Active” and “Crossing Health” status inputs are each

correctly indicated in the Server Status Update message:

1. Using RBWT or TEFKAS with crossing normal and "Advance Start Enable" switch enabled, check that "HSOK", "ASE", and "Crossing Health" statuses are "True" and that "Crossing Active" is "False".
2. Activate crossing and insure that "CA" changes to "True".
3. Two minutes after crossing is activated, "HSOK" should change to "False".
4. Five minutes after crossing is activated "CH" should change to "False".
5. Restore crossing to normal. "CA" should change to "False". Then change "ASE" switch to "Disable" position. "ASE" should change to "False".

Check and record each input to insure that "True" and "False" statuses occur at the proper times.

b. With "Advance Start Enable" switch enabled, test crossing with an ITCS equipped train at Maximum Authorized Speed to insure that ITCS Advance Start provides correct warning time. Record Total Warning Time (the time that starts when the ITCS Advance Start drops the XR relay and ends when the island circuit drops, indicating the train has arrived at the crossing), and record the Regular Warning Time (the time that starts when the crossing approach track circuit drops and ends when the island circuit drops). The ITCS Advance Warning Time is determined by subtracting the Regular Warning Time from the Total Warning Time. This test is to be performed in each direction on each ITCS equipped track. When RBWT is available, the verification may be performed without a test train by setting pre-start timers.

c. With "Advance Start Enable" switch enabled, test crossing with an ITCS equipped train operated toward the crossing at Maximum Authorized Speed, and establish radio contact between the test train and the crossing being tested. Just after train arms crossing, turn off power to Spread Spectrum Radio at crossing while simultaneously notifying on board test personnel at the exact time timing should start. Record elapsed time on board until CLD displays appropriate target speed; this time should not exceed 21 seconds. Crossing should activate immediately when SSR is turned off. CLD should display the crossing default speed as the target speed unless a signal at or near the crossing displays an aspect requiring a lower speed. If there is a signal at the crossing that shares the SSR, the target speed will be "Zero" and the target will be "AUTOSIG" or "HOMESIG". Bad health should be displayed on TEFKAS or RBWT. Record that crossing is activated with SSR turned off, and record actual target speed and the target displayed on CLD. This test may also be performed with an ITCS equipped Highway Rail Car, in lieu of a test train, operated toward the crossing at approximately 35 MPH. HRC should be NOT shunting, and just after HRC arms crossing, turn off power to SSR at crossing while notifying HRC to start timing. Record all items listed above. This test is to be performed in one direction.

d. With "Advance Start Enable" switch enabled, test crossing with an ITCS equipped Highway Rail Car operated at approximately 35 MPH toward the cross-

ing. Establish radio contact between the HRC and the crossing location, and open control of GPR relay before HRC arrives at crossing start location. Verify that crossing health changes from "True" to "False" by RBWT, TEFKAS, or other approved means. Verify that the CLD displays a target speed of 15 MPH and the target "XING". Record initial time to penalty when CLD changes to "15 MPH" and "XING". This test is to be performed in one direction.

e. With "Advance Start Enable" switch enabled, open XBP input circuits to ITCS equipment. Verify that crossing health changes from "True" to "False" by RBWT, TEFKAS, or other approved means. If a test train is used, this test need be made in only one direction.

Test 22B
ITCS SERVER DATABASE FILE VERIFICATION

Frequency:
Upon new ITCS installation or upon any modifications or disarrangement of server files contained in Server EPROMS IC15 or IC17. This includes changes to Signals, Switches, Interlocking ("OS") Track Circuits, Highway Crossing Warning Systems, Milepost Locations, Track Grade, and/or locations of BEGIN ITCS or END ITCS Territory Signs.

Procedure:
When a Server Configuration, Table of Indications – Passenger, Table of Indications – Freight, Track Profile, Track Map, Civil Speed Restrictions (Permanent) or

Table of Indications Label database file is changed affecting EPROM IC15 or IC17, the following tests

shall be performed to verify that data in all database files is correct.

1. For any database file that changed in the new ERPROM, a hard copy printout of both the current and post change database file must be generated. These must be visually inspected for the correct change. New reversion numbers of all changed files must be verified and CRC values of all changed files must be verified.

2. After the new EPROM is installed, a check of the EPROM must be made to verify that the CRC value for each changed file in the newly installed EPROM matches the CRC value for that file on the hard copy printout.

3. Any of the above database file in this EPROM that did not change must be verified to have the same CRC value as before the implementation of the change.

a. For changes to file:
1. Server Configuration (Server EPROM IC15 only), verify with RBWT or TEFKAS that on-board equipment in the server area can receive a STATUS UPDATE message, and that current statuses for signals, switches, interlocking ("OS") track circuits, and highway crossings are correct. **IF** there are no changes to Server EPROM IC17, **THEN** Test 22A need not be performed. Test 22C, however, must be performed.
b. For any changes to any of the following files in Server EPROM IC17:
2. Table of Indications – Passenger,
3. Table of Indications – Freight,
4. Track Profile, or
5. Track Map,

Test 22A and Test 22C must be performed in addition to Test 22B.

c. For changes to the following files in Server EPROM IC17:

6. Civil Speed Restriction (Permanent), or
7. Table of Indications Label,

IF the data in files 2, 3, 4, and 5 (listed in Test 22B3b above) can be verified to have **NOT** changed, **THEN** neither Test 22A nor Test 22C need be performed. This verification may be made by ensuring the individual CRC's have not changed in the new EPROM for each file other than the File 6 and/or 7 being changed. This verification must be recorded on form C&S 27 as Test 22B3c.

Test 22C
ITCS TEMPORARY SLOW ORDER VERIFICATION

Frequency:
Upon new ITCS installation or upon any modification or disarrangement of Office or Field Software in the OWL or of Server EPROM IC15, Server EPROM IC17 (except File 6, "Civil Speed Restriction" or File 7, "Table of Indications Label"), or Server EPROM IC18.

Procedure:
Verify at the WIU-SERVER that a Temporary Slow Order can be placed anywhere in affected ITCS Territory by every office so authorized and removed by every office so authorized. Using RBWT or a HRC, verify that the file received at the WIU-SERVER, including the track, speed, beginning location, and ending location of the Territory Slow Order, is the same as entered at the office. RBWT can display the file and limits, whereas use of an HRC will require cutting in ITCS, and verifying the actual enforcement of the real TSO. Record these verifications on form C&S 27.

Test 22D
ITCS COMPONENT REPLACEMENT VERIFICATION

Frequency:
Upon new ITCS installation or upon replacement of any ITCS component with an equivalent component.

Procedure:
When any ITCS component is replaced with an equivalent component, verify that the most current version of the component or device is being installed. For specific replacements listed below, perform the required verifications in each case, recording the actions and the results on form C&S 27.

1. MCP, MCP Antenna, MCP cables replaced at a WIU-SERVER. At the limits on either side of the WIU-SERVER's section, verify that ON-BOARD equipment in the served area can receive a BEACON MESSAGE from the WIU-SERVER.

2. GPS, RIM, RIM Antenna, RIM cables replaced at a WIU-SERVER. Verify that the ON-BOARD equipment in the served area can receive both a BEACON MESSAGE and a STATUS UPDATE MESSAGE from the WIU-SERVER. Verify that the differential correction health status is true in the STATUS UPDATE MESSAGE.

3. GPS Reference, Antenna, cables re- placed at a WIU-SERVER. Verify that the ON-BOARD equipment in the served area can receive both a DIFFERENTIAL CORRECTION MESSAGE and a STATUS UPDATE MESSAGE from the WIU-SERVER. Verify that the differential correction health status is true in the STATUS UPDATE MESSAGE.

4. SSR Radio, Antenna, cables replaced. For a WIU-SERVER, verify data is received at the WIU-SERVER from all other WLAN WIU's. For a WIU, verify data is received at its WIU-SERVER. The above shall be tested by verifying the link statuses using the diagnostic port of the WIU-SERVER.

5. Office Equipment, Modem or In Line Amplifiers replaced. Verify that a Temporary Slow Order can be issued by all offices so authorized, and removed by all offices so authorized.

6. Serial Module replaced on a WIU-SERVER. Verify that the ON-BOARD equipment in the served area can receive a DIFFERENTIAL CORRECTION message and a STATUS UPDATE message, and using RBWT or TEFKAS, that the STATUS UPDATE message contains the correct current statuses for the signals, switches, interlocking ("OS") track circuits, and highway crossings in that server's section.

7. Any other module replaced in the WIU or WIU SERVER. Verify restored operation of the WIU. Reception of Status Update Message containing changing data from the WIU with the replaced module is a proper method.

TEST 23: NEW INSTALLATIONS OR MODIFICATIONS TO INTERLOCKINGS AUTOMATIC SIGNALS AND HIGHWAY CROSSING SIGNALS, OR REPORTED OR SUSPECTED FALSE PROCEED INDICATION OF ANY VITAL SIGNAL SYSTEM

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	236.4, 234.209, 234.105

Purpose:

This test insures that new installations or modifications to existing installations are operating as intended.

Responsibility:

Foreman C&S, Inspector C&S, Assistant Inspector Test, Maintainer C&S Test, or Signal Inspector.

Records:

Results for Test 23 shall be recorded on Form C&S-27 showing the number of each test performed, the date tested and by whom. The Foreman in charge shall sign the C&S-27 only after all required tests have been completed. A separate form shall be filled out for each separate test as required by the C&S-27.

For Test 23C – False Proceeds: The Assistant Division Engineer – C&S shall complete and submit a false proceed incident report within 7 days of report or incident to the Office of the Chief Engineer- C&S.

For Test 23D – Activation Failures: The Assistant Division Engineer C & S shall complete, and submit FRA form No-F6180.83 Highway Rail Grade Crossing Warning System Failure Report to the Deputy Chief Engineer C & S within 5-days of the occurrence.

Results:

All discrepancies must be corrected and adjustments must be made before the facility is placed into service unless authorized by the Supervisor C&S who must make temporary arrangements for the safe protection of trains. If conditions are observed in which the approved plans do not seem to provide proper protection or flexibility of operation, such conditions shall be immediately protected and

brought to the attention of the Supervisor C&S and Assistant Division Engineer C&S.

TEST 23A
OPERATIONAL CHECK

Frequency:

Before new installations or modifications to existing installations are placed into service.

Procedure:

1. A complete operational check to insure proper switch locking and proper sequence of operations must be made, including:
   - signal aspects,
   - cab signal codes,
   - opposing and conflicting signal protection,
   - and that facilities are functioning as intended.
2. In addition, all applicable AMT 27 tests shall be made on such installations or modifications at this time.
3. With the route lined through the interlocking (or portion of the interlocking) being tested, place the next signal beyond the interlocking (or portion being tested) to its most restrictive aspect, and observe that the signal being tested displays “Approach”, “Medium Approach”, “Slow Approach”, or “Diverging Approach” as required in the route being tested.
4. Without changing the route, it will then be necessary to look at each of the <u>other</u> routes leaving the interlocking (or portion being tested) in the same direction as the route being tested, as follows:

a. For each route other than the route lined, arrange to display the best aspect on the next signal. Observe the incoming control ("D", "AD", "BD" or "HF") for each track on these other routes. Ensure that the signal under test does not display a better aspect then intended.

b. The incoming "D", "AD", "BD" or "HF" controls may occur simultaneously, one by one, or in any combination to expedite the checking, but all must be seen to ensure that none causes the "Approach", "Medium Approach", "Slow Approach", or "Diverging Approach" aspect to upgrade on the signal being tested.

5. With the original route lined, arrange the signal under test to display "Stop and Proceed" or "Restricting" (as required by the route being tested) by occupying any portion of the first block beyond the interlocking in the route lined (re-establishing the directional stick if necessary to accomplish this).

6. Look at the incoming "H" controls for each other route in the same direction as lined from the signal being tested, to ensure that the receipt of an energized "H" control for any track on these other routes will not cause the signal under test to display a better aspect than intended. The incoming "H" controls may be arranged simultaneously, one by one, or in any combination, but all must be checked against the signal and the route being tested.

7. New installations must be given a detailed check promptly upon installation as indicated below in Test 23B. Plans-so-marked must be

given a detailed check. All subsequent changes must be checked and plans-so-marked must be checked promptly upon completion. Note: Reference C & S Engineering Practice No. 5003 Cutover Procedures Governing Installation & Modification to the Signal System before planning cutover. This practice can be found on the Amtrak Intranet under Library/Manuals/Engineering Practice/ C & S Engineering Practices Spec. No. 5003

TEST 23A.1
OPERATIONAL CHECK FOLLOW STICK CIRCUITS
Purpose:
To ensure that Signal displays a "Restricting Aspect" for following train movements routed into an occupied block.

Frequency:
Before new installations or modifications to existing installations are placed into service.

Procedure:

1. Line Route into the Block.

2. Display signal, verify aspect, and run shunt into the block, leaving shunt down on the exit block track circuit.

3. Display signal for the identical route, and at least one diverging route leading into the occupied block, (in the same direction) observing signal aspect in each case to ensure that signal displays no more favorable aspect than "Restricting".

Note: Circuits shall be designed such that there is only one follow stick circuit per exit track. Test only required where circuits are designed with follow stick circuits.

TEST 23B

DETAIL CHECK OF LAYOUT, LOCKING AND CIRCUITS

Frequency:

Before new installations or modifications to existing installations are placed into service.

Procedure:

1. Check layout conditions in the field for agreement with layout plans concerning
   a. track arrangement;
   b. number, location, frog angle and fouling point of crossovers and turnouts;
   c. location, type, aspects and routing of signals;
   d. location of tower, signal housings, buildings, bridges, poles and other structures which affect preview of signals and operation of signal system.
2. Inspect physical conditions of:
   a. tracks and switches,
   b. signal bridges,
   c. foundations,
   d. pipe lines,
   e. machine,
   f. tower,
   g. signal housings and any other buildings involved.
3. Check signal housings, tower and other buildings for fire hazards.
4. Check locking and dog sheets in accordance with Test 1.
5. Check circuit conditions in the field for agreement with layout plans concerning the condition and location of :

a. insulated joints,
b. fouling points,
c. fouling wires,
d. batteries and chargers,
e. relay connections and locations,
f. wires and cables,
g. switch circuit controllers and rods,
h. transformers,
i. switch movements,
j. switch valves,
k. electric switch locks,
l. and all other apparatus on or about the tracks.

6. Each relay (or other signal apparatus) location must be inspected to insure:

   a. that the location contains all the apparatus called for on plans and that there is no excess apparatus or foreign material,

   b. that the apparatus is of proper type and has proper inspection dates,

   c. and that power and battery supplies are provided, and fused and designated according to plan

7. Check must be made of the number in use, kind, condition and adjustment of contacts in relays, electric locks, circuit controllers, releases, and similar devices, and tagging wire nomenclature of wires to controls and contacts.

8. Check must be made of interlocking machine spring combination condition and adjustment, type of quadrants, type and adjustment of segments and cutting and adjustments in electric locks.

9. Before new installation or modifications to existing circuit wiring is placed in service a

detailed **Point Check** must be completed to ensure wiring agrees with the circuit plans. Circuit plan must be signed and dated by the employee responsible to complete the Point Check of wiring. Test must be made of all circuits to ensure that the opening of each contact in control circuit cuts off the control current under conditions shown on plan, following through all multiple circuits and cutarounds. When a circuit is broken over a relay twice, or when it is broken over some other contact that will be opened by opening the relay, the wires in the circuit must be disconnected for test in addition to the opening of the relay. Note: Except as noted above, manipulation of relays to drop away, or pick up, should be the process utilized to open circuits, in order to expedite breakdown testing.

10. Conditions found that are not in accordance with approved plans shall be corrected at once, or steps shall be taken to revise the plans to agree with the work.

11. All index plates on bases and plug-in relays must be checked to insure that the prescribed pins and holes for each relay are properly installed and secured.

12. All eproms containing vital signal logic must be verified with approved plan for each specific item of equipment at each location. This verification must include all information on plan and eprom label. This shall include identification number, revision number, date and check sums. In case of doubt, check sums must be verified in eprom burner.

13. Inspect signal cases and housing to insure all excess material has been disposed of and

the installation renders a neat and orderly appearance.

14. When making these checks and tests, if conditions are observed in which the approved plans do not seem to provide proper protection or flexibility of operation such conditions shall be immediately protected and reported to Supervisor C&S and Assistant Division Engineer C&S.

TEST 23C

FALSE PROCEED

Frequency:

Upon receipt of a reported false proceed.

Procedure:

1. When the signal system is reported to have given a False Proceed, or suspected of giving False Proceed information, the system shall be given a complete operational check to insure proper switch locking and proper sequence of operations including
   a. signal aspects,
   b. cab signal codes,
   c. opposing and conflicting signal protection and overrun protection.
2. It must be insured that facilities are functioning as intended. **(Verify sequence of events through recording devices where available).**
3. If the False Proceed, or reported False Proceed cannot be duplicated and verified as to cause, then a 24-hour signal watch is to be established, verifying all signal aspects, cab signal aspects, and switch positions in the route involved.

4. In addition, all applicable AMT-27 tests shall be made on such installations as follows:
   a. Test 2, Insulation Resistance to include control, indication, lighting, and local wiring.
   b. Test 4, Relays and other Electro-Magnetic Apparatus to insure that relays are within specification and are according to approved plan.
   c. Test 18 Ground Readings
   d. Test 24 Track Circuits
   e. Test 23B, Detail Check of Layout, Locking and Circuits
5. Depending on conditions and circumstances, the following tests may be required:
   a. Test 9 Time Locking
   b. Test 10 Timing Devices
   c. Test 11 Switches
   d. Test 13 Switches
   e. Test 15 Route Locking
   f. Test 16 Traffic Locking
   g. Test 19 Fouling Circuit
   h. Test 20 Switch Circuit Controllers
   i. Test 26 Highway Crossings
   j. Test 27 Insulated Rail Joints
   k. Test 29 Restricting Code Change Point
   l. Test 30 Approach Medium Code Change
   m. Test 36 Audio Frequency Overlay Devices
6. The Assistant Division Engineer-C&S shall record and provide the following:
   a. False Proceed Report Form

b. Electronically recorded engine data shall be transferred and maintained in electronic and written format.

c. Reporting Engineer Interview Report Form

Test 23D
Report of Grade Crossing Activation Failure

Frequency:
Upon receipt of a reported activation failure as defined in 49 CFR 234.5:

"Activation failure" means the failure of an active highway-rail grade crossing warning system to indicate the approach of a train at least 20-seconds prior to the train arrival at the crossing, unless the crossing is provided with an alternative means of active warning to highway users of approaching trains. Within the meaning of this paragraph a system does not indicate the approach of a train if more than 50% of the flashers (not gate lights or back lights) on any approach lane fail to function properly.) This failure indicates to the motorist that it is safe to proceed across the railroad tracks, when in fact it is not safe to do so!

Procedure:

1. Ensure that the Dispatcher has issued "stop and protect" order. (NORAC Form "D" or GCOR Track bulletin)

2. Notify Supervisor or Manager in charge of section immediately. If possible obtain names and phone numbers of witnesses or persons who reported the incident. *(This is critical in order to eliminate nuisance reports from the general public and law enforcement*

who may not be familiar with railroad operations)

3. Ascertain what track is involved, and direction of train movement from reporting person or Train Dispatcher.

4. Supervisor will immediately contact Customer service personnel to have the Locomotive Engineer of the train interviewed, and Locomotive event recorder downloaded as soon as possible.

5. Communicate with Train Dispatcher, Agency reporting failure, or other pertinent witnesses to ascertain whether gates came down, flashers operated, and train crew to determine what signal aspects were observed / operated under.

6. If an accident is at the highway crossing equipped with automatic devices, an operational test of the installation must be made checking that apparatus is functioning properly. Where apparatus has been damaged the crossing must be protected until repairs have been made. If the accident involves personal injury or fatality, or if signals are found or are suspected of giving false indication, or if switches or other apparatus have not functioned properly, the housing enclosing the apparatus which may be involved in the accident must be sealed without change or repair until inspected or otherwise directed by the Deputy Chief Engineer C & S or his representative. (Reference AMT-23 Rule number (57) fifty-seven.

7. Arrange for the downloading of the Highway Grade Crossing event recorder after receiving proper authority.

8. If recorder, witness interviews, or operational test indicates the failure of a particular piece of equipment or circuit that item must be repaired, replaced or removed from service immediately. Crossing will remain out of service until repairs, or modifications are made.

9. Where an accident results from signal failure, the FRA shall be notified by the Assistant Division Engineer C & S or his representative within 24-hours of the occurrence by telephone (800) 424-0201 in accordance with 49 CFR 233.5

10. Test 26 A, B & C will be performed as soon as possible and all readings and results documented on proper test form.

11. In addition all applicable AMT-27 tests shall be made as follows:

    a. Test 2, Insulation resistance test to include gate mechanism cables, flashers circuits, track wires, express cable, and all local wiring.

    b. Test 3, Foreign Current DC & 60 Hz. Non-Coded track if applicable.

    c. Test 4, Relays, and other electro mechanical apparatus to ensure that relays are within specification, and are according to approved plan.

d. Test 10, Time Releases, Timing Relays, and Timing Devices

e. Test 18, Ground Tests

f. Test 24, Track Circuits

g. Test 36, Audio Frequency Overlay Devices Including Highway Crossing Predictors, Block Joint / Overrun Detectors, and Presence Detectors.

12. Depending on conditions, and circumstances the following tests may be required:

a. Test 11 Switches
b. Test 13 Switches
c. Test 19 Fouling Circuits
d. Test 20 Switch Circuit Controllers
e. Test 23B Detail Check of Layout, Locking, and Circuits.
f. Test 27 Insulated Rail Joints

If the reported activation failure cannot be duplicated, or no defects / exceptions are found, and the crossing is not equipped with an event recorder for verification purposes, the crossing shall be monitored for 24 hours. During this period of time the operation of the crossing must be observed, and all train movement time documented.

The results of all tests must be properly documented and submitted to the Assistant Division Engineer C & S promptly. Assistant Division Engineer C & S will send completed report FRA form F6180.83 to the Deputy Chief Engineer C & S within 5-days of the occurrence.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.51, 236.56, 236.59

Purpose:

TEST 24A -To insure track relays and track receiver units are not over energized.

TEST 24B -To insure that track relays, and devices that function as track relays are in their most restrictive state when occupied by other than a track car.

TEST 24C -To insure that coded cab signals are properly adjusted to provide accurate block information to the cab of the engine.

TEST 24D -To insure that the track circuit polarity is in accordance with the plans and to maximize protection against defective insulated joints isolating adjoining track circuits.

TEST 24E -To insure that the track circuit is properly cross bonded and, should a broken rail or open head bond occur, the track relay or device utilized, as a track relay will assume its most restrictive position.

TEST 24F -To insure that all track circuit wire connections are properly secured and tight.

TEST 24G -To insure the proper operation of the cab signal test and cut-in circuits.

TEST 24H –Test is to insure that track circuits are effectively shunted by light- weight equipment.

Responsibility:

Assistant Inspector Test, Maintainer C&S Test, Signal Inspector, or Maintainer C&S.

Records:

Results of Test 24 for track input voltage shall be recorded on Forms C&S-24 and C&S-27 in duplicate, with the track circuit nomenclature and all appropriate readings. C&S-24 form to be left in the house or case and a copy forwarded to the office of the Supervisor C&S. C&S-27 form to be forwarded to the office of the Supervisor C&S.

Results:

Any track circuit failing to meet the requirements of the above tests shall be repaired or corrected immediately. If rectification of discrepancies cannot be immediately achieved, then the Supervisor C&S must be informed and arrangements must be made for the safe protection of trains.

TEST 24A
TRACK CIRCUIT INPUT MEASUREMENT

Frequency:

At least once every two years or if the electrical operating characteristics of the track circuit are significantly altered. For example: change in ballast conditions due to track being undercut and ballast renewed, welded rail, replacing jointed rail, track section extensively bonded, "Z" type impedance bonds being replaced by mini-bonds, change in any track circuit component, etc.

Procedure:

Conventional Track Relays and Electronic Track Circuits

1. Take voltage reading on relay track input terminals.
2. Place ammeter in series with track fuse, pull the track fuse and observe current reading.
3. For Electronic Track Circuits, take voltage and current readings according to manufacturers' instructions.

TRU-II Track Circuit (Use Simpson 260 or Digital Meter)

1. Take AC voltage reading on track input to TRU-II unit.
2. Take DC voltage reading on output of TRU-II unit.

3. With meter still connected to TRU-II output, remove the 3 amp. track fuse. Output to relay must not exceed 2.5 volts DC.
4. Connect ammeter in series across open fuse to read current to TRU-II unit.
5. TRU-II units in cab signal territory must be checked to insure that they pick up (reset) on receipt of the highest possible code (180 or 270 where used).
6. Record AC Reference Voltage.

SE-3 Track Circuit
100-Hertz Steady Energy Track Circuit
(Use Simpson Ts-111, Triplett Model 2000-2001, or Digital Voltmeter such as Fluke Model-87)

Procedure:

1. Take voltage reading across the SE-3 local reference input terminals BX-110, and NX-110. Voltage should be between 105, and 125-volts A.C. Note: If using Fluke digital meter that provides frequency readout, also measure the frequency that should be between 98, and 102 Hertz.

2. Take voltage reading across the track circuit Input terminal BX, and NX. Level should be between 9.5 and 11.5 volts A.C. when track is not shunted.

3. Take voltage reading across the relay terminals. Level should be between 0.415 and 0.450-volts D. C. with the track not shunted. Shunt track with a 0.25-ohm shunt. Voltage must drop below 0.275-volts, and the relay must drop.

4. If the code-reset receiver is used, code at all applicable code rates to assure that the unit resets. The reset LED indication can be observed to determine if a reset has been achieved without resetting to steady energy.

Note: There are no adjustments to the SE-3 receiver. All track circuit level adjustments must be at the track feed-end of the circuit.

Phase Selective Track Circuit

1. Read AC track voltage on the phase selective unit by connecting the meter to the input wires on the PSU.
2. Read DC output to the normal coil of the track relay, then to the reverse coil of the track relay.
3. Take current reading by placing ammeter in series with the track fuse. Pull the track fuse and read the peak current.
4. Record AC reference voltage.

TEST 24B

SHUNTING SENSITIVITY

Frequency:

At least once every two years or if the electrical operating characteristics of the track circuit are significantly altered. For example: change in ballast conditions due to track being undercut and ballast renewed, welded rail, replacing jointed rail, track section extensively bonded, "Z" type impedance bonds being replaced by mini-bonds, change in any track circuit component, etc.

Test Procedure:

1. Test should be made when weather is dry, when the maximum current is flowing through the rails and the ballast resistance is highest. If during new installations or extensive renew-

als, testing is performed when wet or raining, test should be repeated as soon as practicable thereafter when weather is dry.

2. Test must be made with an approved Amtrak shunt resistance device, capable of reading shunting sensitivity in small increments from 0.05 ohms to 1.2 ohms.
3. Connect the shunting device to track circuit at either the feed or relay end. Select the maximum resistance that will drop the relay.
4. Repeat for the other end of the track circuit.
5. Any track circuit that fails to shunt with a resistance less than the minimum shown in the following table must be reported to the Supervisor C&S.

Table 24-1
Normal Maximum Shunting Resistance Range

Track Circuit Type	Minimum	Maximum
Centrifugal Relay	0.10 Ω	0.20 Ω
AC Vane	0.10 Ω	0.20 Ω
TRU-II	0.15 Ω	0.25 Ω
SE-3	0.15 Ω	0.25 Ω
Phase Selective Coded Track	0.15 Ω	0.25 Ω
AC Electronic Coded Track	0.15 Ω	0.25 Ω
DC 4 Ohm Relay	0.10 Ω	0.20 Ω
DC 1 Ohm Relay	0.10 Ω	0.20 Ω
DC 0.5 Ohm Relay	0.15 Ω	0.25 Ω
DC Coded Track	0.15 Ω	0.25 Ω
DC Electronic Coded Track	0.15 Ω	0.20 Ω
*Audio Frequency Devices	0.15 Ω	0.20 Ω

* Report as part of Test 36

6. All track circuits ***must*** shunt with a minimum resistance of .06 ohms.

TEST 24C
CAB SIGNAL AXLE CURRENT

Frequency:

At least once every two years or if the electrical operating characteristics of the track circuit are significantly altered. For example: change in ballast conditions due to track being undercut and ballast renewed, welded rail, replacing jointed rail, track section extensively bonded, "Z" type impedance bonds being replaced by mini-bonds, change in any track circuit component, etc.

Procedure:

ABS Territory

1. Insure that the advance signal has at least an approach aspect to avoid the cab signal from dropping out due to a code change point.
2. Place an ammeter at the entering end of the track circuit from rail to rail and read peak current.
3. Adjust to insure at least 2 amperes axle current at the entering end with sufficient margin to cover all track circuit conditions without sacrificing broken rail protection. For 250 Hz. Track circuits, a minimum of 1.5 amperes at the entering end with sufficient margin to cover all track circuit conditions without sacrificing broken rail protection. Leaving end axle current should not exceed 12 amperes. If leaving end axle current exceeds 12 amps, Supervisor C&S and Assistant Division Engineer C&S must be promptly notified. Under no circumstances must leaving end current exceed 20 amperes.

Interlockings

1. Have a signal displayed for a route. Insure that the aspect on the wayside signal will conform to a cab signal aspect other than restricting.
2. Place an ammeter at the entering end of the track circuit from rail to rail and read peak current.
3. Adjust to insure at least 2 amperes axle current at the entering end with sufficient margin to cover all track circuit conditions without sacrificing broken rail protection for 91.67 Hz and 100 Hz and a minimum of 1.5 amperes for 250 Hz. Leaving end axle current should not exceed 12 amperes at either frequency. If leaving end axle current exceeds 12 amps, Supervisor C&S and Assistant Division Engineer C&S must be promptly notified. Under no circumstances must leaving end current at either frequency to exceed 20 amperes.

NOTE: When checking reverse feed cab signal code, the normal track circuit feed must be opened prior to connecting an Amp Meter to read reverse code. Also be aware for code change points that may remove cab signals before a reading is taken.

TEST 24D
POLARITY AND INSULATED JOINT PROTECTION

Frequency:

At least once every two years or if the electrical operating characteristics of the track circuit are significantly altered. For example: change in ballast conditions due to track being undercut and ballast renewed, welded rail, replacing jointed rail, track section extensively bonded, "Z" type impedance bonds being replaced by mini-bonds, change in any track circuit component, etc.

Note: At Interlocking, check to insure that the relay being tested has an established feed on the adjoining track circuit.

Procedure:

DC Track Circuits

1. Test by applying voltmeter to track circuit which will show actual polarity of the circuit.
2. Bridge each insulated joint simultaneously, (Figure 24-1) observing that the relay drops to its most restrictive position.

Centrifugal Track Circuit

1. Disconnect feed from the track circuit being tested or place a hard wire shunt at least 500 feet from the relay.
2. After the rotor has come to rest, bridge each insulated joint separately, (Figure 24-1) observing the relay. If the rotor turns backwards or attempts to spin back against the ratchet stop, polarity is satisfactory.
3. Replace feed or remove shunt.

TRU-II Track Circuit

1. Disconnect the feed from the track circuit being tested. Do not place a shunt on the track as the TRU-II track circuit will not properly respond to the test.

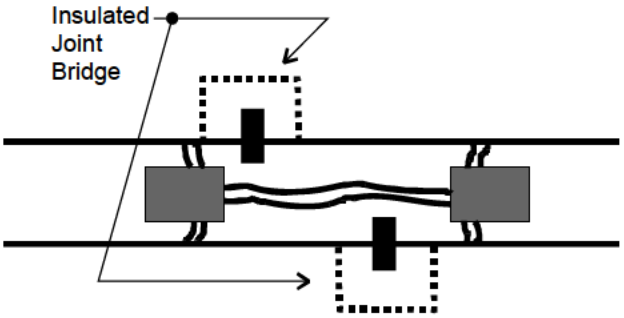


Figure 24-1

2. Bridge each insulated joint simultaneously, (Figure 24-1) observing that the track relay does not attempt to pick and DC output from TRU-II unit does not exceed 6 volts.
3. Simultaneously cross shunt the insulated joints diagonally (see fig. 24-2). Observe that the relay should attempt to pick momentarily and DC OUT increases to approximately 9 volts or more. If these results are obtained, test is performed satisfactorily.
4. Replace feed to track circuit.

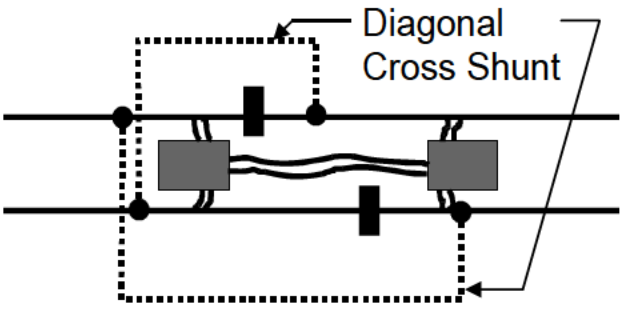


Figure 24-2

SE-3 Track Circuit

1. Disconnect track circuit feed, observe that track relay is de-energized, and down.

2. Bridge each insulated joint simultaneously. Relay must stay down, and relay-drive (D.C.) voltage, must be below 0.10-volts. Refer to Figure 24-1

3. Simultaneously cross shunt the insulated joints diagonally. Observe that the relay stays down, and relay drive (DC) voltage must be below 0.10-volts. Reference Fig. 24-2 **Note:** This portion of test only required with adjoining SE-3 track circuits

4. Reverse phase of the track wires at the receiver. Relay voltage must drop below 0.10 volts, and the relay must stay down.

Phase Selective Track Circuits In Electrified territory, at all locations other than Cut Sections.

1. Disconnect the feed from the track circuit being tested. Observe that the track relay is in the local or reference position.
2. Bridge both insulated joints simultaneously (see figure 24-1) with a:

   a. .15 ohm shunt

   b. .45 ohm shunt

   c. 0 ohm shunt (hard wire shunt)

   Monitoring track input to the PSU to ensure it's not over energized, and observing that the track relay does not attempt to operate.
3. With NO Trains approaching, "X" the insulated joints momentarily (Diagonally, first one-way, then the other) Track relay should try to operate momentarily. If these results are obtained, polarity is satisfactory (Staggered).

4. Replace feed to the track circuit.

Phase Selective Track Circuits In ABS With Cut Sections

1. In ABS territory where phase selective track circuits with cut sections are used, insure that a shunt (Figure 24-3) placed in the second track section in advance of the signal, or removal of

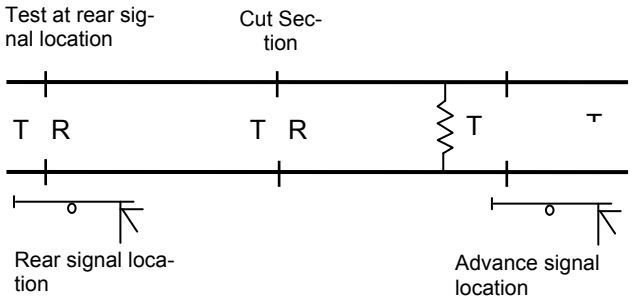


Figure 24-3
Track Circuit

the feed in the second circuit will keep the first track circuit in advance of the signal de-energized with an absence of any track voltage.

2 Polarity at the cut section may be like or staggered, but must be as specified on the circuit plan.

Single Element Universal Coded Track Circuits

1. Bridge each insulated joint individually for electrified territory or simultaneously for non-electrified territory. (Figure 24-1).
2. The track relay should stop on its front contact with the signal displaying its most restrictive aspect.

AC Electronic Coded Track Circuits

1. Bridge each insulated joint individually for electrified territory or simultaneously for non-electrified territory. (Figure 24-1).
2. Observe that the signal assumes its most restrictive aspect and vital codes are not being transmitted in either direction.

DC Electronic Track Circuits

1. Test by applying voltmeter to track circuit which will show actual polarity of the circuit. Insure that the polarity is staggered.

TEST 24E

BROKEN RAIL PROTECTION (Electrified Territory Only, Where Maximum Authorized Speed Exceeds 30-MPH)

Frequency:

When the traction return system on either end of the track circuit is altered in any manner or any new or relocated cross bonding connected to neutral leads on track involved within 12,000 feet in either direction, and when an electrical characteristic or component of the track circuit is replaced.

Procedure:

1. With no electric trains in the area, disconnect one side of the impedance bond from the rail and the track lead from the same rail.

2. Clamp the track lead and the impedance bond side lead together.

3. Observe the track relay and insure that it doesn't attempt to pick up. When testing Phase Selective track circuits observe the TFBPR, and insure it doesn't pick up.

NOTE: Exercise extreme caution to avoid electrically bridging any portion of the body between the side leads and the rail or the neutral leads and the rail or the impedance bond cover and the rail. Additionally, do not allow casual metallic contact of any of these items to any portions of the body to prevent any possibility of stray traction arcing.

4. Restore the side leads and the track wire to the rail and observe that the track relay picks up.

5. Repeat for the opposite rail.

NOTE: If this test fails at any location and test 24A and 24B indicate that track circuit is not over-energized, check that cross bonding is installed in accordance with Traction Bonding Plan at least three locations either side of location failing test. Ideally, cross-bonds should not be located closer together than 6,000 feet, and should include at least one non-cross-bond location between cross-bond location.

The length of the longest track circuit between adjacent cross-bond locations should not exceed 60% of the total distance between cross bonds. If the distance between cross-bonds is less than 6,000 feet, two intermediate non-cross-bond locations should be provided and the length of the longest track circuit should not exceed 40% of the total distance between cross-bonds.

A "cross-bond" is defined as an electrical connection between the neutral lead of the track being tested and/or any other track, neutralizing wire, or structure bonded to static or aerial ground wire. Such electrical connection must be capable of carrying traction loads in accordance with standard plans.

NOTE: Grounding or drain wires connected directly to running rail will not be permitted in signal territory.

TEST 24F

VISUAL INSPECTION OF TRACK CIRCUIT COMPONENTS

Frequency:

At least once every six months

Procedure:

1. Inspect all track circuit bond wires. Replace all broken, frayed and loose bonds.
2. Inspect all bonding on shunt fouling sections and series fouling sections to insure fouling wires are all double bonded and intact. Replace all broken, frayed and loose bonds.
3. Inspect all track connections for damage to bond strand due to dragging equipment or track machinery. Repair or replace any bond strand that has been damaged.
4. Inspect impedance bond leads. Insure that all leads are intact and securely attached. Impedance bond leads that are missing or damaged must be repaired immediately.
5. Inspect track circuit lightning arresters and surge protectors to insure that they are intact and have not been damaged by lightning or traction. Replace any arresters or surge protectors that appear to have been damaged.

TEST 24G
CAB SIGNAL TEST AND CUT-IN CIRCUITS

Frequency:

At least once every six months.

Procedure:

1. Inspect cab signal cut-in loops for damage due to vandalism, dragging equipment or track machinery. Repair or replace any loop wire that has been damaged.
2. Check test circuit for proper codes by manually operating the test switch.
3. Insure that the current level to the cab loop is between 1.3 and 1.6 amps.
4. Check running test circuit to insure that all codes are present and in proper sequence (180-120-75-0). Measure axle current to determine that it is as near to 2 amperes as possible.
5. Check cut-in circuit to insure that the proper codes are consistent with the wayside signal aspects (distant and home).
6. Test axle current as outlined in Test 24C.

TEST 24H

RDC AND LIGHT WEIGHT EQUIPMENT SHUNTING EFFICIENCY TEST

Frequency:

At least once every year in territory utilizing RDC or other light weight equipment.

Procedure:

1. Place proper electrical meter on relay end of track circuit.
2. Observe meter to insure proper voltage levels while track is occupied by light weight equipment moving through the entire circuit.

Purpose:
Test is to determine if the protective apparatus installed is operative and in good condition.

Responsibility:
Maintainer C&S

Records:
Results of Test 25 shall be recorded on Form C&S-27.

Results:
Any device or apparatus not in compliance with the inspection below must be reported to the Supervisor C&S promptly.

TEST 25
PROTECTION OF TRACKS USED IN LOADING OR UNLOADING FLAMMABLES

Frequency:
At least once each year.

Inspection Procedure:

1. Ensure that:
   - insulated rail joints,
   - ground wires,
   - other protective equipment

   are intact and working as intended.
2. Compare with Standard Plan SP807. Sheet 1 of 2.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 234.247 thru 234.273

Purpose:
This test is to determine that all equipment in connection with each Highway Grade Crossing installation is in good working order and functioning as intended.

Responsibility:
TEST 26 A - Maintainer C&S
TEST 26 B - Maintainer C&S
TEST 26 C - Maintainer C&S with Foreman C&S or Inspector C&S

Records:
All results for Test 26 shall be recorded in duplicate on Forms C&S 26 and C&S 27. It is to be sent to the Supervisor C&S.

Results:
Any defects or discrepancies shall be noted on the test form and corrected immediately. If defects cannot be immediately corrected, the Supervisor C&S must be notified and arrangements must be made for the safe passage of rail and highway traffic as per FRA 234.105 or 234.107.

TEST 26A

HIGHWAY GRADE CROSSINGS

Frequency:
At least once each month.

Procedure:
1. Observe line control and/or track relays and directional stick or interlocking relays to ascertain proper condition.
2. Open AC power feed to place installation on standby battery.

3. Operate the crossing warning devices and determine there are no burned out lamps and that the auxiliary devices such as crossing bell, No Turn, 2nd Train signs are operating properly. (Where test switch is provided such as knife switch or shunt plug use this means to operate warning devices.)
4. Observe if lamps appear to have normal brilliance after operating a minimum of two minutes. At crossings equipped with gates, the operation of the gates down and up may be used in lieu of two minutes of flashing light operation.
5. Measure voltage of main batteries and overlay batteries at the crossing while charge is off and batteries are supplying the lighting load and record values on battery card.
6. Wipe dust off flasher roundels using a soft clothe and water if necessary, and determine as far as practicable that the alignment has not been disturbed.
7. Observe that no obstruction interfered with gate operation or obscures view of lamps.
8. Restore AC power and protection to normal operation and determine that all rectifiers are energized by AC. If definite hum is not detected at each rectifier, check actual charging current to insure batteries are being charged.
9. Measure voltage of main batteries and overlay batteries while on charge, and record values on the battery card. Values must be in accord with values shown in AMT 23 or manufacturers' instructions for the type of cell. If not, rectifiers should be adjusted.
10. Inspect main and track batteries at the highway location for height of electrolyte, tightness of connections and cleanliness.

11. At crossings equipped with predictors, record all display information such as RX value, phase angle, error codes, etc. Review and record the warning times of the past six trains, notifying Supervisor C&S of any irregularities immediately.

12. Inspect highway traffic signal preemption interconnections by simulating a train occupying approach track circuit, verify correct preemption warning time, and that traffic signal (Indication) light so operates to clear the tracks of vehicles, before a train could occupy the crossing.

13. Inspect gate arms and mechanisms for signs of damage, stress, misdjustment, or improper operation. Where shear pins and spring loaded gate arms are used, they must be inspected. Also, check that raise and lower buttons are functioning as intended, where provided.

14. Operate crossing to insure that the crossing gates begin to descend 3 to 5 seconds after the flashers activate. In Connecticut, the gates must begin to lower after seven seconds of lights and bells.

15 Insure that the gates descend together and reach full horizontal position simultaneously 10 to 15 seconds after starting down. In Connecticut, gates must reach full horizontal position after 17 seconds from activation. Insure that the gates are fully down a minimum of 5 seconds before the train arrives.

NOTE: Total warning time must be a minimum of 20 seconds.

16 Insure that crossing bell or other audible warning device (where provided) operates when flashers activate and remain in opera-

tion until the crossing gate reaches approximately 5° from full horizontal.

17 With gates in the horizontal position, insure that they are straight and parallel with the roadway surface without “drooping”.

18 Check loops that detect vehicle occupancy by observing at least one vehicle in each direction, and ensure that the loops are activated sequentially.

Note: Ensure Highway Crossing Warning Devices are functioning as intended after completing all tests.

TEST 26B
HIGHWAY GRADE CROSSINGS

Frequency:

At least once every three months.

Procedure:

1. Inspect main and track batteries at the highway approach location for height of electrolyte, tightness of connections and cleanliness.
2. Check actual charging current (not rectifier output) of all batteries at highway and approach locations and record on battery record card. Charging currents and voltage of cells under charge should be adjusted in accordance with AMT 23 or manufacturer’s instructions for the particular battery and temperature. If necessary to add water, re-cord on battery record card.
3. Inspect all bond, fouling, track connecting wires, and insulated joints within the approaches to the crossing.
4. Inspect all insulated joints within the approaches to the crossing.

5. Each cut-out circuit shall be tested to determine that the circuit functions as intended. A cut-out circuit is any circuit which overrides the operation of automatic warning systems. This includes both switch cutout circuits and devices which enable personnel to manually override the operation of automatic warning systems. Note: Ensure Highway Crossing Warning Devices are functioning as intended after completing all tests.

TEST 26C

HIGHWAY GRADE CROSSINGS

Frequency:

At least once every year.

Procedure:

1. Check visibility and focus of signals, visibility and condition of signs including RR advance warning signs on the highway, and CC signs or equivalent.
2. Electric gates must be checked to see that the gates raise to full upright position no more than 12 seconds after the gates are permitted to clear.
3. Check the number of flashes per minute. If found to be less than 40 or more than 55 arrange for correction.
4. Check flashing contacts by observing that at least one lamp on each flasher unit and two lights on each gate arm are burning when flasher is at rest.
5. Check voltage at lamps after AC power has been off for two minutes. Flasher relay should

be de-energized when voltage readings are taken.

Voltage at lamp must be maintained at not less than 85% of the prescribed lamp rating by varying resistors in the lamp circuit.

6. AC power should then be restored and transformer taps adjusted to provide correct voltage. Gate arm lamp voltages should be checked at junction box or gate mechanism case.
7. Take hydrometer readings on:
   a. All nickel-iron and nickel cadmium cells. Specific gravity should be in accordance with AMT 23. Gravity reading, electrolyte temperature and height of electrolyte below upper limit line readings are to be recorded on battery record card.
   b. All maintainable lead-acid type batteries at main and approach locations in accordance with AMT-23 before addition of water. Gravity reading, electrolyte temperature and height of electrolyte below upper limit line readings are to be recorded on battery record card.
8. Where circuit controllers are in service on outlying switches to cut out operation of crossing protection, test each circuit controller with a 3/8 inch obstruction between reverse switch point and stock rail. Contacts should not assume the position that crossing cutout protection is effective.
9. Check gate arm torque adjustment in accordance with manufacturer's instruction to insure that gate arms are free from friction or other interference that might prevent them from functioning as intended.

10. Test the hold clear device for proper operation. Hold clear devices are not required to be tested for operating values. An observation of the hold clear device to ensure that it is functioning properly is an acceptable means of testing.
11. Check time delay of starting circuits. Time shall not exceed that shown on plans.
12. Check time delay of cut-out circuits. Time shall not be less than that shown on plans.
13. Where protection is automatic using directional stick relays, check operation for each track in each direction and after tests are completed, observe that directional stick relays are de-energized.
14. Grade crossing predictors, motion sensors and overlay track circuits shall be tested in accordance with manufacturer's instructions.
15. Test each track in each direction for prescribed warning times using maximum authorized speed or the actual speed of train used for warning time and calculate warning time for authorized speed. Verify Preemption warning time is in accordance with circuit drawings. Predictors or electronic records that accurately determine actual warning times may be used to determine warning times.
16. Activate crossing warning devices utilizing test switch or dropping an approach circuit.. Then utilizing a vehicle, drive close enough to the entrance gate to foul the 1st loop. Ensure cab relay(s) drop out. Pick up the gate high enough so that vehicle can go through, and foul the middle loop.

When the entrance gate is detected not down, (Broken Gate Detection) the exit gate in that lane should start to rise. After activating the middle loop with vehicle, and restoring the entrance gate, the exit gate should remain up, and cab signal should remain at restricting. Continue driving thru the next loop, observing that the exit gate remains up. When vehicle clears the exit loop, the crossing should return to normal with all gates in the down position and cab signal restored to normal. Repeat for the other direction of traffic.

Note: Ensure Highway Crossing Warning Devices are functioning as intended after completing all tests.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.59

Purpose:

Test is to determine if the protective apparatus installed is operative and in good condition.

Responsibility:

Maintainer C&S

Records:

Results of Test 27 shall be recorded on Form C&S-27.

Results:

Indication of any poor insulation must be tested, then if found to be defective, reported to the Supervisor C&S promptly.

TEST 27

INSULATING RAIL JOINTS, SWITCH INSULATION, DRAW BRIDGE INSULATION AND ANY TYPE OF INSULATION APPARATUS THAT WOULD AFFECT THE INTEGRITY OF A TRACK CIRCUIT.

Frequency:

At least once every three months

Inspection Procedure:

All insulation must be visually inspected and if inspection indicates poor conditions of insulation, test shall be made in accordance with Standard Plan SP818. Insulated joints **MUST** also be inspected for spikes, rail anchors, tie plates, rail flow, end post missing and any condition that would bridge the insulation of the joint. In addition, switches **MUST** be inspected for rod clearances that would bridge the insulation and affect the integrity of the track circuit. Conditions accountable to the C&S Department that would affect the integrity of the track circuit, **MUST** be corrected immediately. All other conditions **MUST** be reported to the immediate Supervisor for correction.

TEST 28: ACSES TRANSPONDER AND ENCODER / WIU INSPECTION AND VERIFICATION

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA Final Order of Particular Applicability; Federal Register/Vol. 63, No. 140/Wednesday, July 22, 1998 Notices – Pages 39355 - 39357

Purpose:

Test 28A: To ensure that ACSES transponders are in good condition for reading by ACSES equipped trains.

Test 28B: To ensure that ACSES equipped trains receive the correct messages at each transponder upon new installation, modification, or any disarrangement of a transponder that would require a new program.

Test 28C: To ensure that ACSES equipped trains receive the correct messages approaching each interlocking equipped with an ACSES encoder, upon new installation, modification, or any disarrangement of the wiring to the encoder, or any change requiring a new, or replaced programmed encoder plug.

Test 28D: To ensure that ACSES equipped trains receive the correct messages approaching each interlocking equipped with an ACSES WIU, upon new installation, modification, or any disarrangement of the wiring to the WIU, or any change requiring a new, or replaced programmed WIU USB plug.

Test 28E: To ensure that both transponder and encoder and/or WIU messages affecting train movement are correct when the transponder and/or encoder or WIU database is changed to the extent that a test train is required.

Responsibility:

Test 28A – Maintainer C&S or Electronic Technician
Test 28B – Foreman C&S, Inspector C&S, Assistant Inspector C&S, Signal Inspector, Maintainer C&S or Electronic Technician.
Test 28C – Foreman C&S, Inspector C&S, Assistant Inspector C&S, Signal Inspector, Maintainer C&S, or Electronic Technician.
Test 28D – Foreman C&S, Inspector C&S, Assistant Inspector C&S, Signal Inspector, Maintainer C&S, or Electronic Technician.
Test 28E – Foreman C&S, Inspector C&S, Assistant Inspector C&S, Signal Inspector, Maintainer C&S, or Electronic Technician.

Records:

Results of Test 28A and Test 28B shall be recorded on Form C&S 27 in duplicate, with one copy left in the signal location with the information sheet and hexadecimal bitmap for each transponder at the location. Forward a copy to the office of the Supervisor C&S. Results of Test 28C or Test 28D shall be recorded on Form C&S 27 in duplicate, with one copy left in the encoder or WIU location with the information sheets for the encoder or WIU. Forward a copy to the office of the Supervisor C&S. Results of Test 28E, including analyses, shall be recorded on the prescribed forms, and filed in the office of the Supervisor C&S. Forward a copy to the office of the Deputy Chief Engineer C&S, with the downloads of data recorded on the test train. Encoder and/or WIU IXI Database and Configuration Sheets will be furnished thru Deputy Chief Engineer office.

Results:

Any defects or discrepancies shall be noted on the test form and corrected immediately. If defects cannot be immediately corrected, the Supervisor C&S must be notified.

TEST 28A
ACSES Transponder Inspection

Frequency:
At least once every three months, and on new installations or when subsequent changes to existing installations are made.

Inspection Procedure:
A visual inspection of all transponders adjacent to an insulated joint location will be made to ensure they are in good condition.

If the perimeter of any transponder is damaged so as to not properly protect the imbedded antenna loop, the transponder must be replaced.

TEST 28B
ACSES Transponder Plug Validation

Frequency:
When a new or modified transponder and/or plug is placed in service
.

Alstom (plug Memory) Transponder:

Procedure:
1. To insert a new or re-programmed plug into a transponder:

a. Examine the label to ensure that the plug is for the correct Railroad, Line, Location, Track, and Transponder Position within the Set, Version, and CRC Number.
b. When all of the above parameters have been verified and with foul time on the

track involved, insert the plug into the transponder.

c. Place the WMT (Wayside Maintenance Tool) in the center of the transponder. Compare the hexadecimal CRC (checksum) on the WMT screen with the printed checksum furnished by the Amtrak C&S Design office, character-by-character.

d. If all characters read on the Transponder Reader screen match the corresponding characters in the checksum furnished for the transponder, the plug is the correct one for that transponder.

e. When all plugs in all transponders in the set have been verified, the track may be placed in service. Record this test on form C&S 27 as test 28B1.

f. If any character(s) in the checksum do not match properly, the plug must be immediately removed from the transponder.

2. To change out a single transponder without the Wayside Maintenance Tool:

a. Remove the transponder to be replaced from the track structure, and place it alongside the new transponder that is to replace the removed transponder, in a location close to the track structure where it was located. Ensure that the old and new transponders are carefully isolated from all other transponders throughout this process.

b. Immediately remove the plug from the old transponder. Examine the label to ensure that the plug shows the correct Railroad, Line, Location, and Track Transponder Position within the Set, Version, and CRC Number. If these parameters are correct, immediately insert the plug into the new transponder. Care must

be exercised that this plug is kept isolated from all other plugs throughout this process.

c. Immediately place the new transponder with the original plug for that transponder location, attaching the transponder to the track structure at that location.

d. After completing a, b, and c above, complete C&S 27 form as a successful completion of Test 28B2, “Transponder Changed Out”.

If unable to comply with a, b, and c above, the transponder must be tested with the Wayside Maintenance Tool before returning the track to service for ACSES equipped trains. Test 28B1 must be followed and recorded on form C&S 27.

Ansaldo (Built-in Memory) Transponder

Procedure:

a. Examine the label to ensure that program is for the correct Railroad, Line, Location, Track, and Transponder Position within the Set, Version, and CRC Number.

b. Turn on the WMT, the alpha numeric display should display “power supply = 100% or closer.

c. With the cable connected from the portable programmer to the transponder, place the transponder under the portable programmer.

d. From your lap top, start the program **C:\Tranedit\tranedit.exe**. When the program starts a window will open, select the File open tab.

e. In the" Look in box" select **C:\Transponder** data.
In the "Files of type box" select TranedCRC files (*.CRC), select the file you want to use to program.
Example **DAVIS_E_1S_E_1.BCB.crc**.
When you select the file a box will open with a long string of hex numbers. To program using this data select the "P down arrow tab". A question box will appear and ask "transponder connected to an encoder?", click the NO tab. A message box will appear and say "sent OK", click OK tab. A message box will appear and say "programming OK", click OK tab.

f. To verify the transponder was programmed, using the computer, select the "R up arrow tab". You will see another box with a long string of hex numbers. The last 9 bytes will **be** the CRC.
Example 04 92E5 A6F0 DB78 727E

COMPLETION

After completing the programming and verification procedure, remove the programming cable from the transponder and reinstall the water tight cap.

Affix the appropriate label to the transponder. Each transponder has a serial number that can be recorded into a database for future records.

Test 28C
ACSES Encoder Wiring and Plug Validation

Frequency:

When new, or modified encoder wiring, and/or encoder plug is placed in service.

Procedure:

1. Encoder Wiring Validation

Encoder wiring must be checked in accordance with Test No. 23A7, and Test 23B before encoder is placed in service, and following any disarrangement before encoder is restored to service. Ensure all wiring is in accordance with the approved plan.

NOTE: If encoder plug is NOT changed during and following a wiring disarrangement, it will not be necessary to perform TEST 28C2; however, TEST 28C1 and 28C3 must be performed. Any known change in wiring, other than restoration of existing wiring, will likely require a change in the encoder plug program, which will also require TEST 28C2 to be performed.

2. Encoder (BCC) Plug Validation

To insert a new or re-programmed plug into an encoder:

a. Examine the label to ensure that the encoder (BCC) plug is for the correct Railroad, Line, Location, Encoder Module, and Version.

(Note: Each Encoder Set consists of one or two Encoder Modules, and each Module requires one plug on the UCS board)

b. Check the new Encoder Configuration sheet, furnished by the Signal Design Group with the new plug, checking it against the current Encoder Configuration sheet associated with the plug to be removed. If all input, output, and board assignments remain the same, Tests 2.1 and 2.3 will not be required.

c. Upon initial installation, or if there are changes in the Encoder Configuration assignments, use the WMT (Wayside Maintenance Tool), with WMT cable connected to the encoder UCS board, se-

lect “1: UCS Maintenance”, and perform the following checks:

2.1 Encoder Input / Output Check:

a. From the UCS Maintenance menu, select “1: Encoder Configuration”.
b. Ensure that the number of input boards installed and displayed on the WMT screen matches the number of input boards programmed and shown on the Encoder Configuration sheet furnished by the Signal Design Group.
c. Ensure that the number of output messages displayed for each board is one more than the number shown on the Encoder Configuration sheet.

2.2 Encoder Address Check:

a. From the UCS Maintenance menu, select “2. Radio Configuration”.
b. Ensure signal assignment range (1 thru 4, or 5 thru 8) displayed on the WMT screen matches that shown on the Encoder Configuration sheets.
c. Ensure that the ATCS address displayed on the WMT screen matches the address to be programmed into the encoder (BCC) plug, as shown on the Encoder Configuration sheets. Record Railroad Number (891 for Amtrak), Line Number, BCP Number, and Encoder assignment, matching each item with the corresponding item on the Encoder Configuration sheets for each Encoder Module.

Optional Procedure

2.3 Encoder Input Setup Check:

Prior to performing Test 28C3, the WMT may be used to verify proper assignment, and continuity of inputs. This may reduce the possibility of failure of current Encoder configuration to pass any part of Test 28C3 after many routes have been successfully tested. This is not a required test, and results do not need to be recorded.

a. From the UCS Maintenance menu, select "3: Input State", and input each input board to be checked.
b. Ensure that all inputs displayed on the WMT screen correspond to the "used" and "unused" inputs shown as programmed into the Encoder (BCC) plug on the Encoder Configuration sheets furnished by the Signal Design Group.
c. Repeat for each input board, checking each input on each board on the applicable Encoder Configuration sheet.

3. Encoder Wiring and Plug Database Validation

NOTE: To ensure encoder wiring and encoder (BCC) plugs act in concert to provide correct messages to trains approaching an interlocking where any encoder wiring and/or encoder plug has been installed, modified or disarranged, the WMT, or Wayside/Carborne Simulator connected with an MCP Radio (WCS/MCP), must be used to validate all messages associated with each interlocking signal and route.
When WCS/MCP is used, this test may be performed from any location within range of an operating ACSES BCP Radio, provided a qualified C&S Employee is stationed at the local control panel of the interlocking being tested, to verify each signal and route tested matches the signal and route information appearing on the laptop screen.

The messages associated with each interlocking signal will include one message for the signal displaying "Stop Signal", and separate messages for each possible route from that signal, including all permitted "run-around" routes, when the signal displays any aspect to proceed. The message for each route will include, but not be limited to, the maximum speed and exit track for the route selected, other tracks crossed between the entrance and exit, distances to the point of divergence from the entrance track and convergence with the exit track, and where braking distance to the next interlocking is short on the exit track se-

lected, the “Length of Movement Authority” distance to that next signal will also be provided. Other grade, radio, and distance information will be included as necessary for the OBC of the approaching train to properly execute display and enforcement of both permanent and temporary speed restrictions through and beyond the interlocking.

This speed, exit, LoMA, and other information for each possible route from each interlocking signal are contained in the site-specific program in the encoder (BCC) plug. This program is different for each interlocking; requiring the utmost care to ensure the correctly programmed plug is inserted in each UCS board in each Encoder Module. Special care must be exercised when any UCS board is changed to ensure the BCC plug remains with the correct Encoder Module, and that it does NOT move with the UCS board. The signal status, and the route selected (when the signal is other than “Stop Signal”) is extracted by this program from the signal and switch logic that is wired into the encoder.
During these tests, the WMT, or WCS/MCP, acts like a train approaching the interlocking, requesting signal and route status for the entrance signal for the track it is on. The encoder should respond to each WMT or WCS/MCP request by sending the same message it would send in response to a real train’s request, based on the current state of the signal and switch position inputs wired into each Encoder Module, as interpreted by the BCC plug(s) programmed for the specific interlocking layout.

Any change in any BCC plug, UCS board, or encoder wiring will require this test, and each such change will require each interlocking signal and each possible route from each signal to be tested. This includes all possible routes in the interlocking.

In the following tests, if the WCS/MCP is used, follow the prompts on the laptop screen to derive the same information detailed below for the WMT.

3.1 Message Selections and Message Content validation:

- With the WMT connected to the encoder TRM board, select “2. TRM Maintenance”.
- From the TRM Maintenance menu, select “2. Radio Request”.
- Press any accepted key to page through the “Direction of Travel” screen and the “Encoder Assignment” screen to the “Signal Assignment” (range) screen.
- Press the correct key, “1” for “1 to 4”, or “2” for “5 to 8”, corresponding to the signal range including the entrance signal to be tested.
- Then press the correct key (1, 2, 3, or 4) corresponding to the signal encoder assignment of the entrance signal to be tested.
- The output message is then displayed on three screens if there is no LoMA, five screens if there is a LoMA, or one screen if an Anomaly message is indicated.
- For the entrance signal selected, select the first route from that signal, and following prompts on the WMT, ensure each of the following line items corresponds exactly with the corresponding line item shown on the Encoder Data Sheet provided with the programmed BCC plug(s) for the interlocking:

a. Message Type (LoMA or No LoMA),
b. Amtrak Line (e.g. NHV - BOS = 891003),

c. Encoder Number,
d. Home Signal Number ("Sig. Assignment" (SiAs)),
e. BCP Number,
f. Entrance Track Number,
g. Maximum Route Speed ("Signal Status" (SiSt)),
h. Route Available ((RoAv) "ON" or "OFF"(Stop)),
i. Exit Track Number,
j. Distance to Speed Increase (ft.) (DiSpInc, yds),
k. Distance to Leave Current Track (DistToTrk),
l. Distance to Enter Exit Track (Dist To Exit),
m. "C" Signal
n Tracks Crossed in Interlocking between Entrance, and exit tracks (TrackCross)
***o.** LoMA Distance (ft.) (from (DistLoma) in yds)
***p.** Worst Controlling Grade (WorstCtrGrade),
***q.** Next Intlg. Radio Channel (NextIXLChannel),
***r.** Next Interlocking Encoder (Enc2),
***s.** Next Interlocking Signal Assignment (SiAs2)
***t.** Next Interlocking BCP Number.

***NOTE**: Not required if there is no LoMA.

If any message on the WMT screen fails to correspond with the corresponding data on the Encoder Data Sheet, or if there is an "Anomaly" message, the test has failed. The problem will need to be diagnosed and corrected before continuing.

- Select the second route from the first signal, and repeat the complete test for that route.

- Select the third route from the first signal, etc.

- Continue until all routes from the first signal selected have been tested, recording the results from each route in the format "1E to 1", "1E to 2", etc. until all routes from the first signal have been tested and recorded.

- Select the second signal, test each route from that signal, recording the results from each route

in sequence in the format, “2E to ”2”, “2E to 1”, etc. until all routes from that signal have been fully tested and recorded.

- Continue until all routes from all signals have been tested and recorded, including the test for each signal displaying Stop Signal with No route lined.

Test 28D
ACSES WIU Wiring and Plug Validation

Frequency:
When new, or modified WIU wiring, and/or WIU plug is placed in service.

Procedure:

1. WIU Wiring Validation
WIU wiring must be checked in accordance with Test No. 23A7, and Test 23B before WIU is placed in service, and following any disarrangement before WIU is restored to service. Ensure all wiring is in accordance with the approved plan.

NOTE: If WIU plug is NOT changed during and following a wiring disarrangement, it will not be necessary to perform TEST 28D2; however, TEST 28D1 and 28D3 must be performed. Any known change in wiring, other than restoration of existing wiring, will likely require a change in the WIU plug program, which will also require TEST 28D2 to be performed.

2. WIU USB Plug Validation
To insert a new or re-programmed plug into a WIU, terminal J10:

a. Examine the label to ensure that the WIU USB plug is for the correct IXL location, Version # and WIU Module (Master or Slave #).

(Note: Each WIU Set consists of one to seven WIU Modules, and each Module requires one USB plug on the J10 USB Port. Each plug is marked with the appropriate master/slave configuration.)

b. Check the new WIU Configuration sheet, furnished by the Signal Design Group with the new USB plug, checking it against the current WIU Configuration sheet associated with the plug to be removed. If all input, output, and network assignments remain the same, Tests 2.1 and 2.3 will not be required.
c. Upon installation of a new or re-programmed USB plug restart the WIU after it has powered up the first time, or if there are changes in the WIU Configuration assignments, restart the WIU, and perform the following checks:

2.1 WIU Input / Output Check:

a. From the WIU Screen, select "1: INPUTS".
b. Ensure that the number of inputs installed and displayed on the WIU screen matches the number of inputs programmed and shown on the WIU Configuration sheet furnished by the Signal Design Group.

2.2 WIU Database and CRC Check:

a. From the main WIU screen select "SYSTEM" on the WIU touch Screen.
b. Enter password "2222"
c. Read the database IXL name at the top of the screen and verify it matches the database IXL name on the attached label of the USB plug, terminal J10 and the WIU IXL database sheet furnished by the PTC Engineering Group.
d. Select "VERSION" on the WIU touch Screen.
e. Read the "Config CRC" at the top of the WIU screen and verify it matches the CRC # on the attached tag of the USB plug, terminal J10 and

the WIU IXL database sheet furnished by the PTC Engineering Group.

f.

Optional Procedure
2.3 WIU Input Setup Check:

Prior to performing Test 28D3, the WIU may be used to verify proper assignment, and continuity of inputs. This may reduce the possibility of failure of current WIU configuration to pass any part of Test 28C3 after many routes have been successfully tested. This is not a required test, and results do not need to be recorded.

a. Using the touchscreen, select the WIU INPUT display. For each Slave WIU, check that the Master WIU input states that correspond to that Slave WIU match.
b. Ensure that all 16 inputs displayed on the master WIU screen and Slave WIU correspond to the "used" and "unused" inputs shown as programmed into the WIU USB plug on the WIU Configuration sheets furnished by the Signal Design Group.
c. Repeat for each slave WIU, checking each input on each board on the applicable WIU Configuration sheet.

3. WIU Wiring and Plug Database Validation

NOTE: To ensure WIU wiring and WIU (USB) plugs act in concert to provide correct messages to trains approaching an interlocking where any WIU wiring and/or WIU plug has been installed, modified or disarranged, the Wayside/Carborne Simulator directly connected (TCP-IP MCM/Bypass Mode) or with an MCM and Radio (WCS/MCM), must be used to validate all messages associated with each interlocking signal and route.
When WCS/MCM is used, this test may be performed from any location within range of an operating ACSES

BRCM and Radio, provided a qualified C&S Employee is stationed at the local control panel of the interlocking being tested, to verify each signal and route tested matches the signal and route information appearing on the laptop screen.

The messages associated with each interlocking signal will include one message for the signal displaying "Stop Signal", and separate messages for each possible route from that signal, including all permitted "run-around" routes, when the signal displays any aspect to proceed. The message for each route will include, but not be limited to, the maximum speed and exit track for the route selected, other tracks crossed between the entrance and exit, distances to the point of divergence from the entrance track and convergence with the exit track, and where braking distance to the next interlocking is short on the exit track selected, the "Length of Movement Authority" distance to that next signal will also be provided. Other grade, radio, and distance information will be included as necessary for the OBC of the approaching train to properly execute display and enforcement of both permanent and temporary speed restrictions through and beyond the interlocking

This speed, exit, LoMA, and other information for each possible route from each interlocking signal are contained in the site-specific program in the WIU (USB) plug. This program is different for each interlocking; requiring the utmost care to ensure the correctly programmed USB plug is inserted in each WIU J10 port board in each master and slave unit. The signal status, and the route selected (when the signal is other than "Stop Signal") is extracted by this program from the signal and switch logic that is wired into the WIU. During these tests, the WCS, acts like a train approaching the interlocking, requesting signal and route status for the entrance signal for the track it is on. The WIU should respond to each WCS request by sending the same message it would send in response to a real train's request, based on the current

state of the signal and switch position inputs wired into each WIU, as interpreted by the USB plug(s) programmed for the specific interlocking layout.
Any change in any USB plug, WIU wiring will require this test, and each such change will require each interlocking signal and each possible route from each signal to be tested. This includes all possible routes in the interlocking.

In the following tests, if the WCS/MCM is used, follow the prompts on the laptop screen to derive the same information detailed below for the WCS.

3.1 Message Selections and Message Content Validation:

- With the PC connected to the WIU J8 Ethernet port via an Ethernet cable configure the PC with the ACSES Adaptor IP address and subnet 255.255.0.0.

- Start the WCS application, select Port menu, “Configure”.

- Select “TCP-IP MCM/Bypass mode, select the Enabled box for “WIU” and input the correct parameters for Local IP, Port and WIU ATCS Address (Source = Destination Address) for WIU communication.

- Select Port menu “Open” the WCS should state that it is “Connected”

- Select settings “Interlocking” and from the dropdown menu select the IXL under test.

- Select settings “WIU Request” and chose the signal to be requested.

- Select settings “Common Params” and select the direction of travel.

- Select the Display window and chose “WIU Data”.

- Select message “WIU Signal Status Request” and push the send message button.

- The IXL Status Response message is then displayed on the screen and labeled No LoMA, LoMA, or Error message.

- For each signal and corresponding routes in the IXL, ensure each of the following line items corresponds exactly with the corresponding line item shown on the WIU IXL Data Sheet provided with the programmed USB plug(s) for the interlocking:

a. Message Type (LoMA or No LoMA),
b. Amtrak Line (e.g. NHV - BOS = 891003),
c. WIU Assignment #,
d. Home Signal Number (“Sig. Assignment” (SiAs)),
e. WIU Sector ID Number,
f. Entrance Track Number,
g. Maximum Route Speed (“Signal Status” (SiSt)),
h. Route Available ((RoAv) “ON” or “OFF”(Stop)),
i. Exit Track Number,
j. Distance to Speed Increase (ft.) (DiSpInc, yds),
k. Distance to Leave Current Track (DistToTrk),
l. Distance to Enter Exit Track (Dist To Exit),
m. “C” Signal
n Tracks Crossed in Interlocking between Entrance, and exit tracks (TrackCross)
***o.** LoMA Distance (ft.) (from (DistLoma) in yds)
***p.** Worst Controlling Grade (WorstCtrGrade),
***q.** Next Intlg. Radio Channel (NextIXLChannel),
***r.** Next Interlocking WIU (WIU2),
***s.** Next Interlocking Signal Assignment (SiAs2)
***t.** Next Interlocking Sector ID Number.

***NOTE**: Not required if there is no LoMA.

If any message on the WCS screen fails to correspond with the corresponding data on the WIU Data Sheet, or if there is an “Anomaly” message, the test has failed. The problem will need to be diagnosed and corrected before continuing.

- Select the second route from the first signal, and repeat the complete test for that route.
- Select the third route from the first signal, etc.
- Continue until all routes from the first signal selected have been tested, recording the results from each route in the format “1E to 1”, “1E to 2”, etc. until all routes from the first signal have been tested and recorded.
- Select the second signal, test each route from that signal, recording the results from each route in sequence in the format, “2E to ”2”, “2E to 1”, etc. until all routes from that signal have been fully tested and recorded.
- Continue until all routes from all signals have been tested and recorded, including the test for each signal displaying Stop Signal with No route lined.

Test 28E
Transponder and Encoder and/or WIU Message Verification Requiring Test Train.

Frequency:
When required by the Office of the Deputy Chief Engineer C&S.

Procedure:
The office of the Deputy Chief Engineer C&S will prepare a Test Plan when this test is required. The Test Plan will describe the area to be tested, the procedure to be followed, the tests required, the data to be collected and recorded, the forms needed to record the data, and any analysis of downloads required. The ACSES Simulator in the office of the Deputy Chief Engineer C&S will be used to minimize testing required by the test train to the extent practicable.

Qualified Division personnel will normally arrange to schedule the Test Train, and coordinate with the Mechanical department, Road Foreman, Train Crew, and the Train Dispatcher, to ensure that all data required by the Test Plan is acquired, and analyzed from the notes, and downloads taken during the tests. ACSESView will be used to expedite the analysis of the data downloaded from the operation of the Test Train.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: FRA 236.511

Purpose:
Test is to Ensure that the track code rate changes to zero within stopping distance on the approach to a signal displaying its most restrictive aspect.

Responsibility:
Maintainer C&S with Foreman C&S or Inspector C&S

Records:
Results of Test 29 shall be recorded on Form C&S-27.

Results:
If any part of Test 29 fails to pass the test or if the time is over that prescribed by the plans, immediate corrective action must be taken and the Supervisor C&S must be notified.

All Tests:
All tests must be made with an approved meter or with a locomotive or MU car equipped with cab signals properly adjusted in accordance with Mechanical Department instructions.

TEST 29A
CODE CHANGE POINTS

Frequency:
When required and upon initial installation.

Procedure:

1. Code change at a cut section:
    a. Ensure that the advance signal displays Stop & Proceed, Stop Signal or Restricting.

b. Place an ammeter shunt outside of the code change track circuit. There should be a 75 code.

c. Place an ammeter shunt within the code change track circuit. There should not be any code.

TEST 29B

AT LOCATIONS WHERE USE OF A TIME DELAY APPARATUS EFFECTS CODE CHANGE

Frequency:

At least once every two years.

Test Procedure:

1. Ensure that the advance signal is displaying Stop Signal, Stop & Proceed or Restricting.
2. Place an ammeter shunt in the approach track circuit to the advance signal.
3. The cab signal must assume zero code within the time shown on the circuit plan or aspect chart.

TEST 29C

AT LOCATIONS WHERE BRIDGING TRANSFORMER OR RELAY SHUNT IS EMPLOYED TO EFFECT CODE CHANGE

Frequency:

At least once every two years.

Procedure:

1. Ensure that the advance signal is displaying Stop Signal, Stop & Proceed, or Restricting.

2. Place an ammeter shunt in the rear of the code change track wires. Verify that 75-cab code is present. Replace amp-meter with a hard wire shunt. Connect amp-meter in advance of the code change track wires There should be **NO** code.

3. Ensure that the track cab code changes to zero a minimum of approximately 1600 feet in the approach to the advance signal. The distance depends on the location of the code change track wires.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.511

Purpose:
Test is to Ensure that the cab signal changes from "Clear" to "Approach Medium" where required at other than signal or block point locations in cab signal territory.

Responsibility:
Maintainer C&S with Foreman C&S or Inspector C&S

Records:
Results of Test 30 shall be recorded on Form C&S-27.

Results:
If any part of Test 30 fails to pass the test or if the time is over that prescribed by the plans, immediate corrective action must be taken and the Supervisor C&S must be notified.

All Tests:
All tests must be made with an approved meter or with a locomotive or MU car equipped with cab signals properly adjusted in accordance with Mechanical Department instructions.

TEST 30A
"APPROACH MEDIUM" CODE CHANGE POINTS

Frequency:

When required and upon initial installation.

Procedure:

1. Code change at a cut section:
   a. Ensure that the advance signal is displaying an aspect to effect an "Approach Medium" code change.
   b. Place an ammeter shunt outside of the code change track circuit. There should be a 180 code.
   c. Place an ammeter shunt within the code change track circuit. There should be a 120 code.

TEST 30B
AT LOCATIONS WHERE USE OF A TIME DELAY APPARATUS EFFECTS CODE CHANGE

Frequency:

At least once every two years.

Procedure:

1. Ensure that the advance signal is displaying an aspect to effect an "Approach Medium" code change.
2. Place an ammeter shunt in the approach track circuit to the advance signal.
3. The cab signal must assume 120 code within the time shown on the circuit plan or aspect chart.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: NONE

Purpose:
Test is to Ensure that the required time has elapsed when the cab signal changes to "Clear" after displaying "Approach Medium" to enforce a civil speed restriction.

Responsibility:
Maintainer C&S with Foreman C&S or Inspector C&S

Records:
Results of Test 31 shall be recorded on Form C&S-27.

Results:
If any part of Test 31 fails to pass the test or, if the time is over that prescribed by the plans, immediate corrective action must be taken and the Supervisor C&S must be notified.

All Tests:
All tests must be made with an approved meter or with a locomotive or MU car equipped with cab signals properly adjusted in accordance with Mechanical Department instructions.

TEST 31A
"CLEAR" CODE CHANGE POINTS

Frequency:
When required and upon initial installation.

Procedure:

1. Ensure that the advance signal is displaying an aspect to effect an "Approach Medium" code change.

2. Place an ammeter shunt in the code change track circuit. There should be a 120 code.
3. Cab signal track code must stay at 120 code rate.

TEST 31B

AT LOCATIONS WHERE USE OF A TIME DELAY APPARATUS EFFECTS CODE CHANGE

Frequency:

At least once every two years.

Procedure:

1. Ensure that the advance signal is displaying an aspect to effect an "Approach Medium" code change
2. Place an ammeter shunt in the code change track circuit. There should be a 120-code.
3. Cab signal track code must stay at 120-code rate for at least the prescribed time shown on the plans.

LEVEL OF MANDATE: STANDARD	REGULATING DOCS.: NONE

Purpose:
Test is to ensure that all train inspection devices and associated equipment are in good order and functioning as intended.

Responsibility:
Inspector C&S, Maintainer C&S Test, Maintainer C&S, Signal Inspector or Electronic Technician

Records:
Results of Test 32 shall be recorded on Form C&S-27. All work and test data must be logged on the test form in duplicate with one copy being forwarded to the Supervisor C&S and the other copy staying at the location.

Results:
If any part of Test 32 fails to pass the test, immediate corrective action must be taken and the Supervisor C&S must be notified.

All Tests:
All tests must be made with approved meters or testing devices appropriate for testing the apparatus described.

TEST 32A
HOT BOX DETECTORS

Frequency:
32A.1 Inspection - At least once per week

Procedure:

1. Check graph or tapes for proper gating, wheels missing and reverse gating.

2. Substantiate that roller bearings are showing 4 to 6 millimeters on the graph for a normal train and that both rails match each other within 1 millimeter.
3. Check that the amount of graph paper is adequate until next inspection.
4. Check all lightning and surge protection for condition.
5. Visually check for loose bolts and broken parts on scanner bases, deflection blocks and transducers.
6. Check voltage of AC power supply and DC storage battery.
7. Check voltage and appropriate levels of system components in accordance with manufacturers specifications.
8. Verify that sensor lens and/or mirrors are clean and have not been damaged.
9. Insure that the scanners shutter freely opens and closes.
10. Check track gauge and inspect tie plates. See that the rail braces are secure and effective. See that the insulation is good and in place.
11. Confirm that the heaters on the shutters are operating in the cold weather.
12. Ensure that the detector will alarm and give proper alarm light and display or give voice information for proper axle count when a differential of 8 millimeters test signal is applied to rail 1 and then applied to rail 2.
13. No alarm should be given if the applied test signal is below 8 millimeters.

Harmon Cyberscan 2000

Frequency:
32A1.1 Inspection at least once per week.

01 Access train history from the event log.
   a. Review columns (self test, C1 and C2)
02 Heat Integrity test:
   a. Check tolerances from the most recent train. Should be 60-degrees or above.
03 Visual Inspection of field equipment.
   a. Test operation of the scanner heaters by sensing surface in area of heater.
   b. Check rail mounted equipment, and tighten if necessary.
   c. Note: Top surface of all transducers must be tight against fillit of head rails. Check routing of all cables (scanner, and transducer) to prevent physical damage.
04 Check, and record the following voltages:
   a. "A" board offset voltages at TP-13 & 14, the value should equal 2V (+) or (-) .3V
   b. Bolometer bias voltage value should equal 200V (+) or (-) 15V

Calibration and Inspection

Frequency:
32A.2 Calibration and Inspection – at least once each month.
Procedure:

1. Perform all weekly inspections.
2. Make a visual inspection of the instrument house, aerial cables, ground rods, and ground connections.

3. Check the batteries, record the per cell readings on the battery card.
4. Check the time and date, correct if necessary.
5. Where a carrier is in use, validate the values in accordance with manufacturers instructions.
6. Calibrate the system following manufacturers instructions.

Harmon – 2000 Monthly
At least once a month by Inspector C&S, Maintainer C&S, Foreman C&S, or Electronic Technician

01 In addition to the weekly test:
   a} Calibrate system with function simulator, and system software. Twice per rail. Acceptable reading for parameter A10, and A11 should be less than 65.

32A.2.1 Harmon – 2000 Quarterly
At least once every three months by Inspector C&S, Maintainer C&S, Foreman C&S, or Electronic Technician.

01 In addition to the monthly test:
   a} Check for the proper physical alignment of the scanner, and transducers as prescribed by the manufacturer.
   b} Clean scanner cover, and if necessary, paint the housing.

Frequency:

32A.3 Test and Inspection – at least once every six months.

Procedure:

1. Perform all weekly and monthly inspections and calibrations.

2. Check the height and alignment of all scanners using the alignment procedure outlined in the C&S Engineering Maintenance Manual.
3. Follow the manufacturers' instructions for performing a heat test. If the detector is a "talker" have a radio to listen to the message as it is broadcasting during the test. The message must be clear and understandable.
4. Test the scanners using the procedures outlined in the C&S Engineering Maintenance Manual.

32A.4 Test and Alignment Harmon – 2000

Frequency:

At least once a year by Inspector C&S, Maintainer C&S, Foreman C&S, or Electronic Technician.

Procedure:

1. Check sensor alignment according to the manufacturers specifications.
2. Check for appropriate signal knockdown in CETC, and in the Interlocking.
3. Arrange to have function simulator calibrated.

TEST 32B

DRAGGING EQUIPMENT DETECTORS

Frequency:

32B.1 Inspection – at least once each month or promptly following an actuation.

Procedure:

1. Visually inspect all Dragging Equipment Detectors to insure proper operation. Insure that they are clean, and any loose parts are made secure.

2. Verify that the ties are solid and there is no play in the detector due to the mounting on the ties.

Frequency:

32B.2 Test – at least once each year.

Procedure:

1. Where dragger is in service in conjunction with track occupancy, shunt the appropriate track circuit.
2. Operate the dragger and confirm that the alarm is sounded, and proper actuation is received.
   a. For self-restoring draggers, deflect plates until contacts open.
   b. For non self-restoring DED's, disconnect the wire at the arm of detector unit.
3. When interconnected with signal circuits, insure that the proper wayside signals are displayed and the "E" light and all associated timing circuits are functioning.
4. Insure that the contacts of the self-restoring dragger are open when plates are deflected 15° and closed when the plates are deflected 10° in both directions.
5. Inspect Ice Deflector equipment, and make repairs, or replacements if necessary.

TEST 32C
HIGH LOAD DETECTOR TEST

Frequency:

32C.1 Carrier Alignment at least once every month.

Procedure:

Carrier must be aligned in accordance with the procedures outlined in the Amtrak Operation and Engineering Manual.

Frequency:

32C.2 Test – at least once every three months.

Procedure:

1. Pass a pole of non-conducting material with a surface not more than 1.5 inches between the light source and receiver of the photo-electric system.
2. The height of the pole above the top of the rail for testing high load detectors must be equal to the specified height of the detector at that location.
3. Check that each passing pole between the light source and the receiver actuates the alarm.
4. When interconnected with signal circuits, check that the proper wayside signal is displayed.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	FRA 236.601

Purpose:
Test is to insure that the slide protection fence is structurally sound and its associated circuits will function to cause the slide protection signals and indicators to display their most restrictive aspects when the apparatus is activated.

Responsibility:
Maintainer C&S

Records:
Results of Test 34 shall be recorded on Form C&S-27.

Results:
If any part of Test 34 fails to pass the test, immediate corrective action must be taken and the Supervisor C&S must be notified.

TEST 34
SLIDE PROTECTION FENCE CIRCUITS

Frequency:
At least once a year.

Procedure:
Manually operate plug connections independently, insuring that the slide protection relay de-energizes as each plug is pulled.

TEST 36: AUDIO FREQUENCY OVERLAY DEVICES INCLUDING HIGHWAY CROSSING PREDICTORS, BLOCK JOINT/OVERRUN DETECTORS AND PRESENCE DETECTORS

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	NONE

Purpose:
Test is to insure that all solid state and microprocessor track circuits are properly adjusted and in accordance with circuit plans.

Responsibility:
Electronic Technician, Assistant Inspector Test, Maintainer C&S Test, or Signal Maintainer

Records:
Results of Test 36 shall be recorded on Form C&S-27 in duplicate with one form to be left in the house or case and one form forwarded to the office of the Supervisor C&S.

Results:
If any part of Test 36 fails to pass the test, immediate corrective action must be taken.

TEST 36A
AUDIO FREQUENCY OVERLAY DEVICES

Frequency:
At least once a year or if circuits or devices are modified or disarranged.

Procedure:

1. Insure that transmitter output levels are within specifications established by the manufacturers' instructions.
2. Insure that receiver sensitivity and selectivity are within specifications established by the manufacturers' instructions.

3. Insure that the frequency is in accordance with the circuit plans.
4. Shunt each track circuit as per test 24B.
5. Test that series electric lock release circuits pick-up at 0.06 ohms shunt.

TEST 36B

CLOSURE RAIL CIRCUITS

Frequency:

Upon initial installation or when modified or disarranged.

Procedure:

1. Line the route to be tested.
2. Clear the home signal for the route to be tested (Note signal aspect).
3. Disconnect track wire to closure rail circuit observing closure rail relay is in the de-energized position.
4. Check signal aspect for route being tested shows more restrictive aspect.
5. Restore closure rail track wire and observe closure rail relay in energized position.

LEVEL OF MANDATE:	REGULATING DOCS.:
STANDARD	NONE

Purpose:
Test is to insure that interlocking and highway crossing recording devices are functioning as intended for time date, accuracy and information.

Responsibility:
Assistant Inspector Test, Maintainer C&S Test, Maintainer C&S or Electronic Technician

Records:
Results of Test 39 shall be recorded on Form C&S-27.

Results:
If any part of Test 39 fails to pass the test, corrective action must be promptly taken.

TEST 39A
TIME AND DATE VERIFICATION

Frequency:
At least once each month.

Procedure:

1. Access each recorder at the location or via modem. (If so equipped)
2. Insure that the time and the date are correct.
3. If multiple recorders are used, insure that they are synchronized.
4. Record several events on both present and past information, insuring that information is without error.
5. If device is sending an alarm, verify that proper sending and receiving information is working as intended.

TEST 39B
DATA VERIFICATION

Frequency:

At least once every four years.

Procedure:

1. Access each recorder at the recorder site.
2. Verify that all inputs to the recorder are capable of being high.

REPORT FORMS

C&S-2.0 (NRPC 2933)
Record of Insulation Resistance

C&S-2.1 (NRPC 2934)
Record of Insulation Resistance

C&S-2A (NRPC 2935)
Record of Insulation Resistance
(Annual)

C&S-2.3 (NRPC 3081)
Record of Insulation Resistance
(Three year)

C&S-4 (NEC 70)
Instrument Record

C&S-27 (NRPC 2919)
Report of Tests of Signal Apparatus

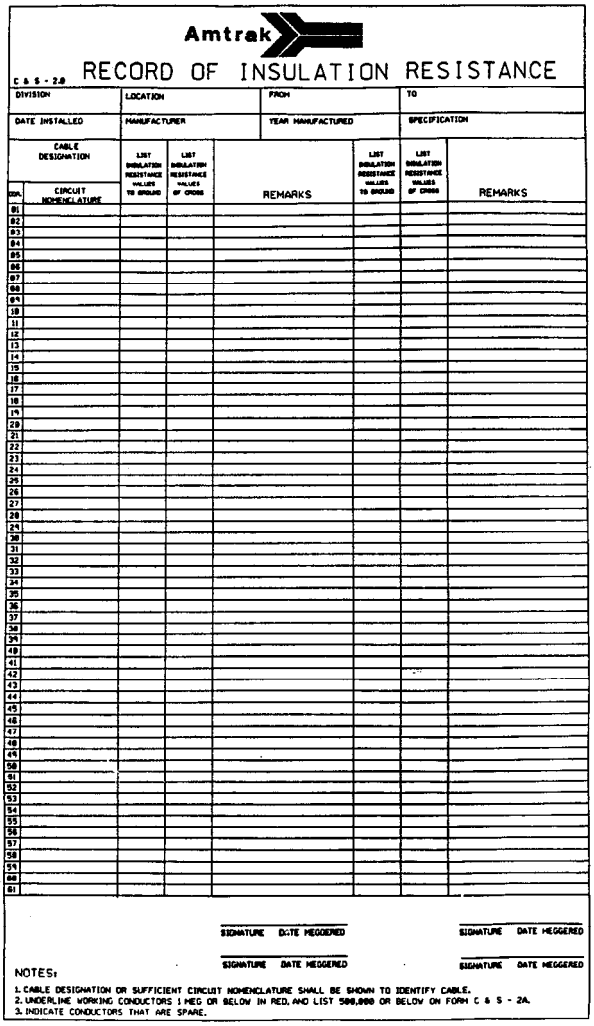
NRPC 2181
Joint Switch and Frog Inspection and Test Report

NEC 14 (NRPC 2194)
Maintainers Daily Report

C&S-18 (NRPC 3082)
Report of Ground Test

C&S-24 (NRPC 3083)
Report of Track Circuit Tests

C&S-26 (NRPC 3084)
Highway Grade Crossing Protection Report Form



Amtrak

C & S - 2.0 RECORD OF INSULATION RESISTANCE

DIVISION	LOCATION	FROM	TO
DATE INSTALLED	MANUFACTURER	YEAR MANUFACTURED	SPECIFICATION

CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS	LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS
CON.	CIRCUIT NOMENCLATURE						
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							
61							

SIGNATURE DATE MEGGERED SIGNATURE DATE MEGGERED

SIGNATURE DATE MEGGERED SIGNATURE DATE MEGGERED

NOTES:
1. CABLE DESIGNATION OR SUFFICIENT CIRCUIT NOMENCLATURE SHALL BE SHOWN TO IDENTIFY CABLE.
2. UNDERLINE WORKING CONDUCTORS 1 MEG OR BELOW IN RED, AND LIST 500,000 OR BELOW ON FORM C & S - 2A.
3. INDICATE CONDUCTORS THAT ARE SPARE.

C&S-2.0 (NRPC 2933)
Record of Insulation Resistance

Amtrak

C & S - 2.1

RECORD OF INSULATION RESISTANCE

DIVISION	LOCATION	FROM	TO
DATE INSTALLED	MANUFACTURER	YEAR MANUFACTURED	SPECIFICATION

CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS	CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS
CDR	CIRCUIT NOMENCLATURE				CDR	CIRCUIT NOMENCLATURE			
01					07				
02					08				
03					09				
04					10				
05					11				
06					12				

SIGNATURE DATE MEGGERED SIGNATURE DATE MEGGERED

DIVISION	LOCATION	FROM	TO
DATE INSTALLED	MANUFACTURER	YEAR MANUFACTURED	SPECIFICATION

CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS	CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS
CDR	CIRCUIT NOMENCLATURE				CDR	CIRCUIT NOMENCLATURE			
01					07				
02					08				
03					09				
04					10				
05					11				
06					12				

SIGNATURE DATE MEGGERED SIGNATURE DATE MEGGERED

DIVISION	LOCATION	FROM	TO
DATE INSTALLED	MANUFACTURER	YEAR MANUFACTURED	SPECIFICATION

CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS	CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS
CDR	CIRCUIT NOMENCLATURE				CDR	CIRCUIT NOMENCLATURE			
01					07				
02					08				
03					09				
04					10				
05					11				
06					12				

SIGNATURE DATE MEGGERED SIGNATURE DATE MEGGERED

DIVISION	LOCATION	FROM	TO
DATE INSTALLED	MANUFACTURER	YEAR MANUFACTURED	SPECIFICATION

CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS	CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS
CDR	CIRCUIT NOMENCLATURE				CDR	CIRCUIT NOMENCLATURE			
01					07				
02					08				
03					09				
04					10				
05					11				
06					12				

NOTES: SIGNATURE DATE MEGGERED SIGNATURE DATE MEGGERED

1. CABLE DESIGNATION OR SUFFICIENT CIRCUIT NOMENCLATURE SHALL BE SHOWN TO IDENTIFY CABLE.
2. UNDERLINE WORKING CONDUCTORS 1 MEG OR BELOW IN RED, AND LIST 500,000 OR BELOW ON FORM C & S - 2A.
3. INDICATE CONDUCTORS THAT ARE SPARE.

C&S-2.1 (NRPC 2934)
Record of Insulation Resistance

RECORD OF INSULATION RESISTANCE C&S 2A
(INCLUDING ONE OR MORE CONDUCTORS REQUIRING ANNUAL TESTING)

DIVISION	LOCATION	FROM	TO
DATE INSTALLED	MANUFACTURER	YEAR MANUFACTURED	SPECIFICATION

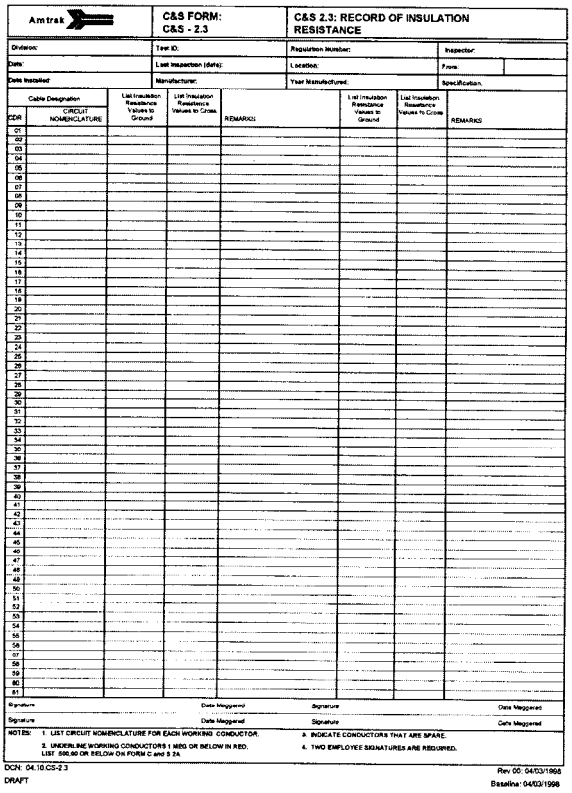
CABLE DESIGNATION		LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS	LIST INSULATION RESISTANCE VALUES TO GROUND	LIST INSULATION RESISTANCE VALUES OF CROSS	REMARKS
CON.	CIRCUIT NOMENCLATURE						
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							
61							

SIGNATURE	DATE MEGGERED	SIGNATURE	DATE MEGGERED
SIGNATURE	DATE MEGGERED	SIGNATURE	DATE MEGGERED

NOTES:
1. LIST CIRCUIT NOMENCLATURE FOR EACH WORKING CONDUCTOR.
2. LIST WORKING CONDUCTORS 500,000 OR LESS ON FORM.
3. INDICATE CONDUCTORS THAT ARE SPARE.
4. TWO SIGNATURES ARE REQUIRED.

NRPC 2935

C&S-2A (NRPC 2935)
Record of Insulation Resistance
(Annual)



Amtrak | C&S FORM: C&S - 2.3 | C&S 2.3: RECORD OF INSULATION RESISTANCE

Division: | Test ID: | Requisition Number: | Inspector:

Date: | Last Inspection (date): | Location: | From:

Date Installed | Manufacturer: | Year Manufactured: | Specification:

CDR	Cable Designation CIRCUIT NOMENCLATURE	Last Insulation Resistance Values to Ground	Last Insulation Resistance Values to Cross	REMARKS	Last Insulation Resistance Values to Ground	Last Insulation Resistance Values to Cross	REMARKS
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							
61							

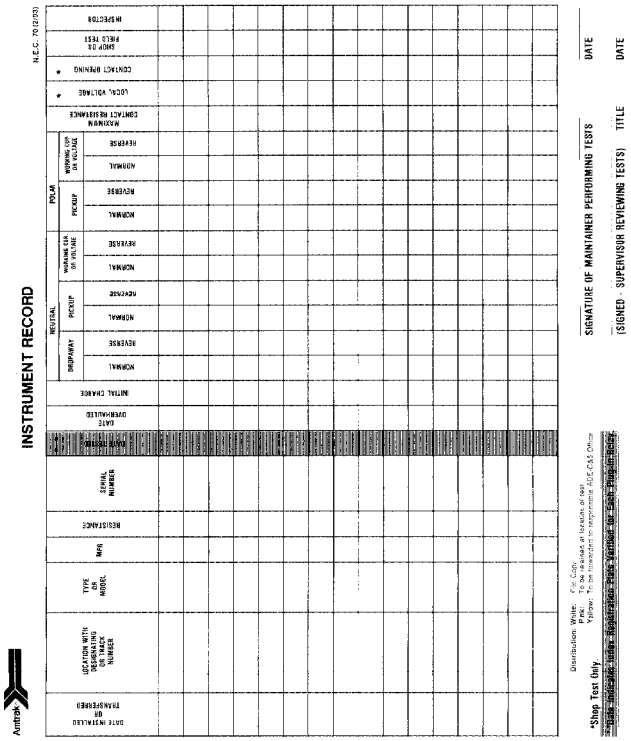
Signature | Date Meggered | Signature | Date Meggered

Signature | Date Meggered | Signature | Date Meggered

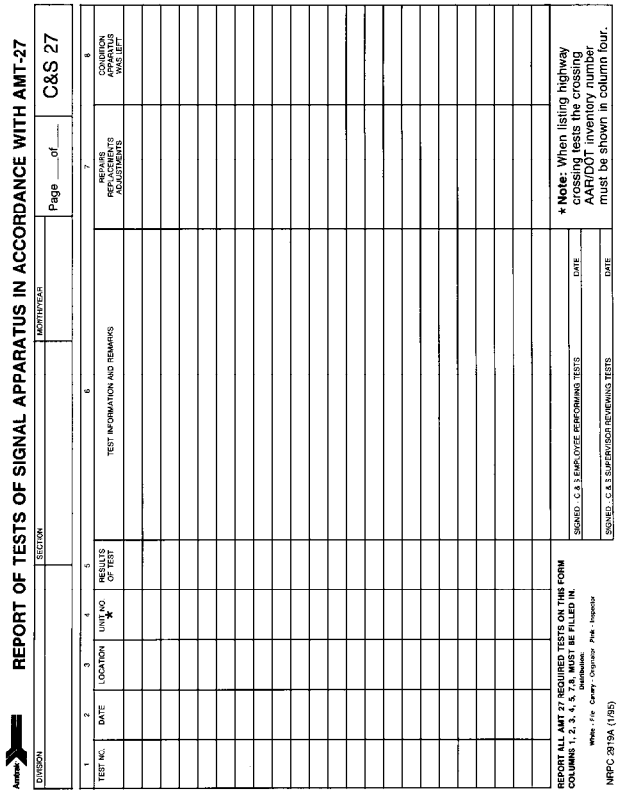
NOTES: 1. LIST CIRCUIT NOMENCLATURE FOR EACH WORKING CONDUCTOR. 3. INDICATE CONDUCTORS THAT ARE SPARE.
2. UNDERLINE WORKING CONDUCTORS 1 MEG OR BELOW IN RED. LIST 500.00 OR BELOW ON FORM C and S 2A. 4. TWO EMPLOYEE SIGNATURES ARE REQUIRED.

DCN: 04.10.CS-2.3 Rev 00: 04/03/1998
DRAFT Baseline: 04/03/1998

C&S-2.3 (NRPC 3081)
Record of Insulation Resistance
(Three year)



C&S-4 (NEC 70)
Instrument Record



REPORT OF TESTS OF SIGNAL APPARATUS IN ACCORDANCE WITH AMT-27

Amtrak

DIVISION | SECTION | MONTH/YEAR | Page ___ of ___ | C&S 27

1 TEST NO.	2 DATE	3 LOCATION	4 UNIT NO. *	5 RESULTS OF TEST	6 TEST INFORMATION AND REMARKS	7 REPAIRS REPLACEMENTS ADJUSTMENTS	8 CONDITION APPARATUS WAS LEFT

REPORT ALL AMT 27 REQUIRED TESTS ON THIS FORM
COLUMNS 1, 2, 3, 4, 5, 7,& 8, MUST BE FILLED IN.
(Mandatory)

White - File Canary - Originator Pink - Inspector

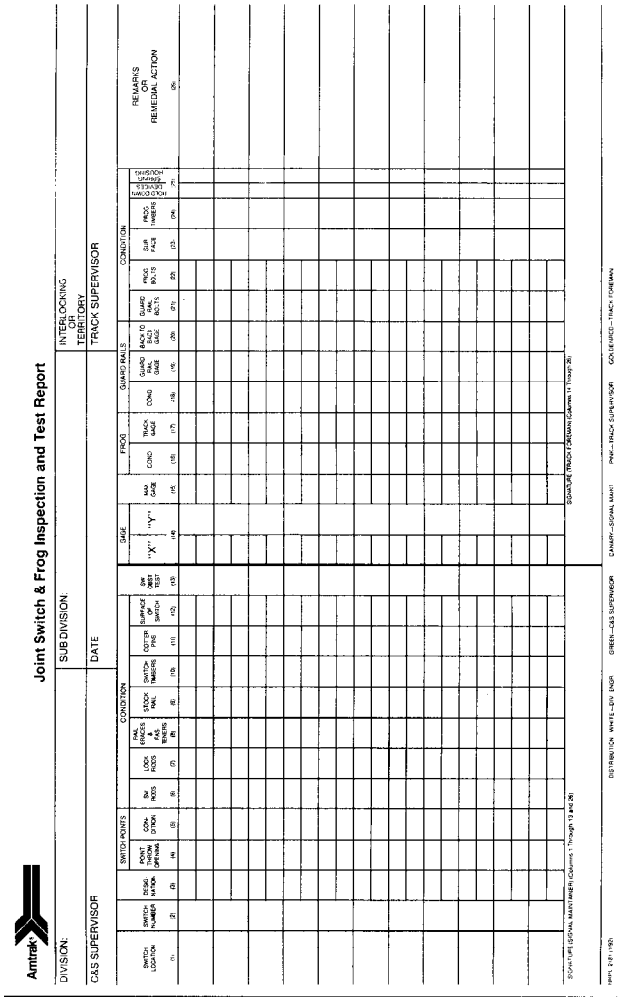
NRPC 2919A (1/95)

SIGNED - C & S EMPLOYEE PERFORMING TESTS ____ DATE

SIGNED - C & S SUPERVISOR REVIEWING TESTS ____ DATE

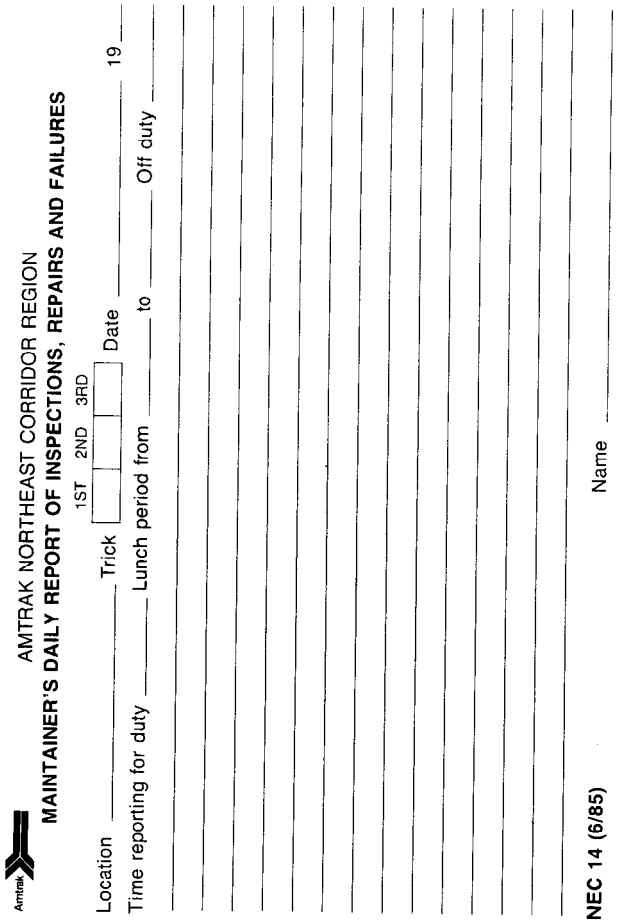
* Note: When listing highway crossing tests the crossing AAR/DOT inventory number must be shown in column four.

C&S-27 (NRPC 2919)
Report of Tests of Signal Apparatus



Joint Switch & Frog Inspection and Test Report

NRPC 2181
Joint Switch and Frog Inspection and Test Report



AMTRAK NORTHEAST CORRIDOR REGION

MAINTAINER'S DAILY REPORT OF INSPECTIONS, REPAIRS AND FAILURES

Location _____ Trick 1ST 2ND 3RD Date _____ 19__

Time reporting for duty _____ Lunch period from _____ to _____ Off duty _____

Name _____

NEC 14 (6/85)

NEC 14 (NRPC 2194)
Maintainers Daily Report

C&S 18 : Report of Ground Test

Division:	**Test ID:**	**Regulation number:**
Sub Division:	**Date:**	**Last Inspection date:**
Inspector:	**Section:**	**Interlocking, Movable Bridge, Highway Grade Crossing and Other Locations:**

Battery Designation	Inspection	Grounds Found POSITIVE (+) V	Grounds Found POSITIVE (+) A	Grounds Found NEGATIVE(-) V	Grounds Found NEGATIVE(-) A	Grounds Left POSITIVE (+) V	Grounds Left POSITIVE (+) A	Grounds Left NEGATIVE(-) V	Grounds Left NEGATIVE(-) A	Date	Signature

Note: For Inspection or Test mark OK or D for Defect. **Form must be turned into Supervisor monthly**

Defects Found/Date	Remedial Action/Date

Inspector's Signature

Supervisor's Signature

C&S 18 (NRPC 3082)
Report of Ground Test

C&S-18 (NRPC 3082)
Report of Ground Test

Amtrak	C&S FORM C&S - 24	C&S 24: Report of Track Circuit Tests	
Division:	Test ID:	Regulation Number:	Inspector:
Supervisor:	Subdivision:	Date:	Last Inspection (date):
Interlocking or Territory:			

To be performed at least once every two years or if the electrical operating characteristics of the track circuit are altered.

TEST 24(A) - TRACK CIRCUIT INPUT VOLTAGE

CIRCUIT #.	TYPE CIRCUIT	INPUT VOLTAGE	OUTPUT VOLTAGE	CURRENT	TRU-OUT with 3 Amp Fuse Removed

CIRCUIT #.	TEST 24(B)	TEST 24(C)	TEST 24(D)	TEST 24(E)	TEST 24(G)

TEST 24(F) - INSPECTION

CIRCUIT #.	BOND WIRES	FOULING WIRES	TRACK LEADS	SIDE LEADS	ARRESTERS, PROTECTORS

1. For Test 24A, write the circuit number. Next, record the type of track circuit. Ex., TRU-II, USS, PSTC, GRS PSTC, etc. For Input, record the input voltage to the TRU- II or phase selective or electronic unit. For Output, record the output voltage from the track unit to the track relay (if aplicable). Current readings should should be taken across an open fuse. The last block in the table is reserved for TRU-II circuit only and is an output reading from the TRU-II unit to the track relay with the track fuse removed. This reading should not be higher than 2.5 VDC.
2. Test 24B is to be marked OK if the track shunts properly or ADJ if adjustments are made.
3. Test 24C should be the recorded value of the cab signal axle current at the entering end of the circuit in both directions.
4. Test 24D should be marked OK if polarity is proper, or FAIL. If FAIL, the foreman or supervisor should be notified.
5. Test 24E is made when required. Box should be marked OK if broken rail protection is intact, or FAIL. If FAIL, the foreman or supervisor should be notified.

Defects Found: **Remedial Action:**

Additional Defects and Remedial Actions should be listed on the back of this form.

Inspector's Signature:

Supervisor's Signature:

DCN: 04.10.CS-24 Rev 00: 04/01/1999

Status: Approved Baseline: 04/01/1999

C&S-24 (NRPC 3083)
Report of Track Circuit Tests

AMTRAK			Highway Grade Crossing Warning Report C&S 26		NRPC 3084
Div.	Sub Div.	Location	Highway	DOT#	Last insp. date
Test #	Regulation#		Inspector		Date

Test 26A Monthly

Procedure	Results	Procedure	Results
1.Line track, Directional stick re ay condition		12.Inspect traff c pre-empt on	
2.Open AC power (RRxg 0n Stand-by Ba tery)		13.Inspect Gate arms & mechanisms for damage	
3.Operate RRxg warning devices		1 .Operate RRxg check that gates descend 3-5	
.Observe lamps & auxil ary dev ces for proper function		seconds after f ashers activate	
5. Measure Voltage Main Batter es &		15.Gates descend together full horizontal 10-15	
Overlay batteries (charger off)		seconds after starting down	
6.Clean lamps, roundels allign lamps		16.Check that bell & other audib e warning operate	
7.Observe that nothing obstructs operation		till gate reaches 5 degrees from Horizontal	
8.Restore AC power & RRxg pro ect on		17.With gates in horizontal posit on Check that	
9.Measure Voltage Main Batteries &		they are para lel w th road surface without drooping	
Overlay batteries (charger on)		18.Check loop detection func ion by observing vehic es	
10.Check batteries fluid evels,		19.Check Grounds: Document on C&S-18 Form	
connect ons & cleanliness		20. Visua ly Inspect Crossing Start Loops	
11.RRxg with pred ctors record all display info		21.Ensure Crossing Warning Devices are func ioning	
		as intended after comp eting tests.	

Test 26B Quarterly

Procedure	Results	Procedure	Results
1. Approach Locations: Check battery		.Inspect all insula ed joints within	
flu d Levels, connections & c ean iness.		the approach of the RRxg	
2.Check actual charging current		5.Test all cut out circu ts	
(not recti ier output) of all batteries		6.Ensure crossing warning devices are functioning	
3.Inspect bonding, fouling, track connect ons		as intended after comp eting tests.	

Test 26C Yearly

Procedure	Results	Procedure	Results
1.Check Visibi ity & focus		9.Check ga e arm torque	
2.Check ga es r se to full upright posit on		10.Check hold clear device	
no more than 12 seconds		11.Check time delay starting circuits	
3.Check flashing rate (w thin 0- 55 per minute)		12.Check time delay cut-out circu ts	
.Check flashing contacts (1)lamp per flasher &		13.Check operat on of directional stick re ays	
(2) lamps per arm when f asher is at rest		1 .Check GCP, motion sensors , overlay circui s	
5.Check lamp (DC) vo tage w th		15.Check warning times for each direct on	
AC power off for 2 minutes		16.Check loop detection func ion by insuring	
6.AC power on check Lamp vo tage (AC)		cabs drop & exit gates r se	
7.Check ba tery E ectroly e		17. Ensure crossing warning devices are functioning	
8.Check Switch Cut out circu t		as intended after comp eting tests.	

Remarks

Results Column as Follows;

C - Test complete Equipment in satisfactory condition
A - Adjustment made, test complete Equip in satisfactory condition
R - Repairs or replacement needed
S -Repairs or replacements made. Equip. in satisfactory condition
- see remarks or additional sheets
(add sheets when additional remarks are needed)

Note: Minimum warning time 20 seconds

Employee's Name (Print)		Supervisor signature	Date
Employee's signature	Date		

C&S-26 (NRPC 3084)
Highway Grade Crossing Warning Report Form