

SSIT-401(c) Vital Relays - Electrical Tests

Purpose

Proper functionality of relays is vital to the safety of train operations and grade crossing warning systems. Relays shall be electrically tested to ensure they are in suitable working condition .

Test Intervals

Vital relay inspections and tests shall be performed when installed, as required, and at least once every four (4) calendar years. Refer to *SSIT-7 Signal System Inspection and Test Intervals* for all test intervals.

Rail Safety

Employee shall ensure the site is safe for employees, the public, vehicular traffic and train operations as defined in *SSIT-8 Protecting Train Operations* prior to performing tests and inspections.

Equipment Manuals

A copy of relevant relay equipment manufacturer's manual shall be on hand for reference when performing tests.

Visual Inspections – Four (4) Year

The following visual inspections shall be performed on all vital relays:

Step	Procedures
1. Perform Visual Inspections	<ul style="list-style-type: none"> Relay inspections shall be done using relay inspection and test procedures <i>SSIT-401(a) Relays – Visual Inspection</i>.
2. Observe Relay Operation	<ul style="list-style-type: none"> Energize and de-energize relay as required to perform observations. → Check there is no contamination that restricts the pick-up of relay. → Check there is no contamination that restricts the drop-away of relay.
3. Inspect Permanent Magnet	<ul style="list-style-type: none"> Energize and de-energize relay as required to perform observations. → Check foreign materials do not partially or completely prevent relay armature from picking and dropping.
4. Observe Contacts in Energized States	<ul style="list-style-type: none"> Energize and de-energize relay as required to perform observations. → Check alignment of front, heel and polar contacts in and between each energized state.
5. Check Clearance of Moving Parts	<ul style="list-style-type: none"> Energize and de-energize relay as required to perform observations. → Check indicator arms and armature do not jam against stationary parts when changing between energized states.
6. Check Armature Movement	<ul style="list-style-type: none"> Energize and de-energize relay as required to perform observations. → Check armature has no evidence of mechanical binding. → Check armature movement is smooth.

Electrical Tests

The following electrical tests shall be performed on all vital relays:

Step	Procedures
1. Check Coil Polarity	<ul style="list-style-type: none"> Connect positive energy to positive terminal, and negative energy to negative terminal. → Check relay is energized. Connect negative energy to positive terminal and positive energy to negative terminal. → Check that unbiased relay is energized. → Check biased relay remains de-energized.
2. Check Contact Resistance (if applicable)	<ul style="list-style-type: none"> When visual inspections indicate contacts are severely pitted or burned, the following resistance values are to be checked against DC Neutral Relay Contact Resistance values (see table below): If resistance greater than typical value: Relay must be removed from service. Apply necessary protection and arrange for relay replacement.
3. Obtain Manufacturer Specifications	<p>The following requirements are required from manufacturer specifications for testing:</p> <ul style="list-style-type: none"> Pick-up value not to exceed percentage of original marking. Working value not to exceed percentage of original marking. Drop-away value not to be less than percentage of pick-up.
4. Test Drop-Away	<ul style="list-style-type: none"> Apply initial current to coil. Reduce current gradually until armature drops away. → Check drop-away value is greater than manufacturer minimum. If drop-away value is less than minimum: Relay must be removed from service. Apply necessary protection and arrange for relay replacement.
5. Test Pick-Up	<ul style="list-style-type: none"> Open circuit for 1 second and apply current to coils. Increase current gradually until front contacts of neutral armature are just closed. → Check pick-up value is under manufacturer maximum If pick-up value exceeds maximum: Relay must be removed from service. Apply necessary protection and arrange for relay replacement.
6. Test Working	<ul style="list-style-type: none"> Increase current gradually until the neutral armature is against the stop. → Check normal working value is under manufacturer maximum If normal working value exceeds maximum: Relay must be removed from service. Apply necessary protection and arrange for relay replacement.
7. Perform Relay Specific Tests	<ul style="list-style-type: none"> Refer to subsequent tables for additional relay specific tests. Refer to relay manual for additional relay specific tests.

DC Neutral Relay Contact Resistance

The values in the following table are to be used as maximums when visual inspection of an in service DC neutral or DC biased neutral relay indicates contacts are severely pitted or burned, which may result in circuit deterioration or failure due to resistance between contact points:

Contact Type	Resistance of Front Contact with Relay Energized to Working Current or Voltage	Resistance of Back Contacts with Relay De-Energized
Metal to Metal	0.03 ohm	0.03 ohm
Metal to Carbon	0.18 ohm	0.36 ohm
Metal to Metal Impregnated Carbon	0.09 ohm	0.18 ohm
Carbon to Carbon	0.40 ohm	0.80 ohm
Metal Impregnated Carbon to Metal Impregnated Carbon	0.20 ohm	0.40 ohm

PO Relays

The following additional tests shall be performed on Power Off (PO) relays:

Step	Procedures
1. Test Relay Pick-up	<ul style="list-style-type: none"> Adjust relay taps on the transformer until the PO front contacts just close. → Check and record AC input voltage to transformer. → Check and record output AC from transformer to relay. → Check that the required voltage is not more than 110% of original marking. <p>If voltage is greater than 110% of original marking: Check stack rectifier is pinned correctly. Retest with a test rectifier. Replace rectifier if required.</p> <p>If voltage still greater than 110% of original marking: Relay to be removed from service.</p>
2. Increase to Normal Working	<ul style="list-style-type: none"> Continue to increase AC voltage until moving element strikes normal or front stop.
3. Check Stick Contacts (if applicable)	<p><i>Stick contact may be used if PO relay receives lower or varying AC voltage resulting in neither front or back contacts closing.</i></p> <ul style="list-style-type: none"> Reduce input voltage until contact drop. Raise input voltage slightly. → Check contacts don't pick until full voltage is applied to the input of the transformer.
4. Test Drop-Away	<ul style="list-style-type: none"> Reduce AC voltage until contacts just open. → Check that the required voltage is not more than 90% of pick-up. <p>If voltage is less than 90% of pick-up: Check stack rectifier is pinned correctly. Retest with a test rectifier. Replace rectifier if required.</p> <p>If voltage still greater than 90% of pick-up: Relay to be removed from service.</p>

Flasher Relays

The following additional tests shall be performed on flasher relays:

Step	Procedures
1. Perform Vital Relay Checks	<ul style="list-style-type: none"> • Disable flasher pack for flasher relay • Test relay as regular vital relay using procedures as described above.
2. Check Flash Rate	<ul style="list-style-type: none"> • Enable flasher pack for flasher relay. <ul style="list-style-type: none"> → Check flash rate of relay falls within relevant criteria: <ul style="list-style-type: none"> ○ 30 to 50 flashes per minute for crossings installed prior to May 18, 1983 ○ 45 to 65 flashes per minute for crossings updated or installed after May 18, 1983 → Check duty cycle is 50%.

Record Test Results

Record the test results for each relay tested:

Step	Procedures
1. Update Log Book	<ul style="list-style-type: none"> • Add any notes of issues observed, or adjustments made.
2. Complete Test Form	<ul style="list-style-type: none"> • Record the test as completed on SSIT test form.