AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: **Engineering (Signalling)** **Category:** **Standard**

AC Single Rail Track Circuits – Set-Up, Test and Certification

SES 04

Applicability

New South Wales	✓	**CRIA (NSW CRN)**	✓

Primary Source

RIC Standard SC 07 43 01 00 WI Version 2.0

Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.3	16 June 2010	Standards	Manager Standards	Exec Manager SS&P 25/06/2010	CEO

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.1	1 September 2004		Reformatting to ARTC standard.
1.2	14 March 2005	Disclaimer	Minor editorial change. Footer reformatted.
1.3	16 June 2010	Various	Transferred 50 Hz Track Circuit History Card to ESI-07-03 and updated references. Transferred document to new template and edited for grammar and style.

Contents

About This Standard

This document describes the procedures for the putting into operation, testing and certification of an AC single rail track circuit equipped with a double element vane relay, in a typical ARTC installation.

Commissioning a new track circuit consists of removing any old equipment, connecting the new equipment and any new bonding, powering up the new equipment, then carrying out the final adjustments and certification checks.

Care must be taken to ensure that none of the necessary checks and tests specified in this document are omitted.

This document applies to all forms of single rail AC track circuit listed in table 1.

Table 1: Single Rail AC Track Circuit Arrangements

Track Cct Type	Track Feed Set	Feed Res Value	Feed Trans Volts(typ)	Relay Prot'n	Min Drop Shunt	Test Shunt
Sig Bch (standard)	St 47	1.0	6	Shield'g Imp	0.25	0.25
Sig Bch (high voltage)	St 51	6	30	25 ohm	0.25	0.25
WB&S	WB&S	16.5	20	'501' Rectifier	0.5	0.5

1 Initial Set-Up

Initial set-up details the activities generally carried out by the set-to-work team. It covers the removal of any old track circuit equipment and the connection and powering up of the new equipment.

1.1 Clear Old Track Connections

Where an existing signalling system is being renewed, the first step is the removal of all old, redundant track circuit connections. This includes old feed and relay connections, impedance bonds and spark-gap connections.

1.2 Bonding and New Connections

Bond out all redundant insulated joints, remove any temporary bonds around new insulated joints and connect any new parallel and series bonds. Check that all mechanical joints are bonded out.

Make all new rail connections and close up all terminal links.

Check that impedance bond sideleads are all of equal length and securely terminated to bond and rails, that neutral connection is secure and track feed and relay cables are correctly terminated.

1.3 Check Bonding and Connections

Walk the length of the track circuit, checking the track against the new track insulation plans.

1.4 Check Auxiliary Track Equipment

Check that any auxiliary track circuit equipment, such as traction tie-in bonds and electrolysis bonds, has been reconnected.

Check that any traction tie-in cables are terminated.

1.5 Equipment Check

Check that the track transformer and feed resistance are correctly installed, with the feed resistance unit of correct value.

Check that surge protection is installed, the correct arrestors are fitted and earthing is installed and correctly terminated.

1.6 Check Auxiliary Track Equipment

Check that any auxiliary track circuit equipment, such as traction tie-in bonds and electrolysis bonds, has been reconnected.

Check that any traction tie-in cables are terminated.

1.7 Equipment Check

Check that the track transformer and feed resistance are correctly installed, with the feed resistance unit of correct value.

Check that surge protection is installed, the correct arrestors are fitted and earthing is installed and correctly terminated.

1.8 Power Up – Feed End

Connect the track feed 120 volt supply and close outgoing cable links. Adjust the feed resistance to about 1.0 ohms.

Set the feed transformer connection to the correct output tap.

Measure feed end rail volts.

Check that track polarity is the reverse of the previous AC track. (Refer to Appendix 1: Technical Notes.) If not, then reverse the connections between the feed set and the feed end impedance bond.

1.9 Power Up – Relay End

Check that surge protection is installed, the correct arrestors are fitted and earthing is installed and correctly terminated.

Close incoming relay fuse and link, and relay local coil Bx120 fuse and link. Observe that the relay energises. The relay should pick up strongly, but not violently.

If the relay drives down, reverse the connections between the relay and relay end impedance bond.

Impedance Bond Resonation

If the track circuit uses 2000 amp/rail resonated impedance bonds, these should now be adjusted.

If the relay does not pick up, or picks up only weakly, it may be necessary to increase the feed transformer secondary volts.

If the relay picks up too strongly, it may be necessary to decrease the feed voltage by increasing the feed resistance (to a maximum of approximately 0.75 ohms) or decreasing the transformer secondary volts.

1.10 Shunt and Correspondence Check

Using a fixed shunt (in accordance with Table 1) applied at the relay end of the track, shunt the track and observe that the relay de-energises.

Where the track circuit is indicated on a signal box diagram, check the correspondence of the track circuit to the diagram indication as part of this shunt check.

2 Final Adjustment and Measurement

Final adjustment involves the adjustment of the track feed set to achieve the specified relay operating values.

2.1 Initial Adjustment

Measure that the relay control voltage is between 120 per cent and 200 per cent of the compression voltage recorded on the relay test label. If it is outside this range, adjust the track feed voltage correspondingly.

Feed voltage adjustments should, as far as possible, be made by adjusting the feed transformer tappings. This will ensure that the feed resistance value is maintained suitably high to provide a good operating phase angle.

2.2 Drop Shunt Check and Final Adjustment

Measure the relay control coil volts (without the shunt applied); this should be about 1 volt, or 50 per cent above the compression voltage recorded on the relay test label, whichever is greater.

Check the drop shunt of the track using a variable shunt unit at the relay end of the track, connected two metres outside the sidelead connections.

The drop shunt measured should be greater than the minimum specified in Table 1. A final drop shunt value between 150 per cent and 200 per cent of the minimum is acceptable. If the initial value is outside this range, an attempt should be made to adjust the track feed for a better drop shunt.

Note: *While the final setting may involve some compromise, it should be possible to achieve a suitable control voltage while retaining a drop shunt value below the 200 per cent value and certainly above the minimum.*

The relay is de-energised when all front contacts can be seen open.

3 Certification

Certification covers the proving of correct operation of the track circuit and the completion of all documentation activities.

3.1 Zero Feed Relay Voltage

With all adjacent tracks operating, disconnect the feed from the track under test and record the AC voltage on the relay control coil.

If the remaining voltage exceeds 30 per cent of the relay release value, this must be reported as a track circuit fault and the cause of the excessive voltage located and rectified.

3.2 Test Shunt

Test shunt the track using a fixed shunt of the value stated in Table 1. Sets of three shunts should be made at the following points, at least:

- two metres from the feed end rail connections
- mid-track
- at both ends of any parallel-bonded section of track (where points are involved) two metres from the relay end rail connections.

3.3 History Cards

When all track work is finished, complete individual history cards for all tracks tested by the team. The cards shall be signed by the responsible member of the team.

4 Appendix 1: Technical Notes

Track Circuit Polarity (Phasing) Check

With AC track circuits, it is critical that at any interface between a pair of tracks that the phasing of one track is opposite to the phasing of the other. This requirement exists to ensure that if the block joints at the interface fail, the relay of one track cannot be held falsely energised by the feed of the other. This requirement can be relaxed at an interface where two feed ends abut.

To check track phasing between two single rail track circuits, measure the voltages on the signalling rail from either side of the block joint to the common traction rail, and the voltage directly across the block joint on the same rail. If the tracks are correctly phased, the sum of the two track circuit voltages will equal the voltage across the joint. If the sum of the voltages is significantly different from the measured value, then the tracks are not correctly phased and corrective action must be taken.

At the interface between single and double rail track circuits, the ‘half-bond’ voltage on the double rail track takes the place of one ‘rail to common’ voltage.

Track Connection Resistance

It is critical that the rail terminations of track connection cables are as low resistance as possible, in view of the high DC and AC currents flowing through them, and especially in view of the need to keep traction return currents balanced. As a guide, the voltages to be expected on good new connections should be less than 2 mV.

Measure the AC voltage drop at each connection between the connecting cable conductors and the head of the rail near the termination. If the cable cores are not accessible, measure from a point on the connection lug, as close as possible to the insulation.

Note: Where duplicated sideleads are fitted, a low millivolt reading will be measured on both, so long as at least one is making good contact.

Any reading over 5 mV should be taken to indicate a suspect connection. Check the tightness of the securing nuts and, if this does not work, dismantle the connection, clean all mating surfaces with abrasive or solvent as required, then reassemble and tighten carefully.

5 Appendix 2: Track Circuit History Card

The ESI0703F-01 50 Hz AC Track Circuit History Card is available on the ARTC Engineering Extranet.