AUSTRALIAN RAIL TRACK CORPORATION LTD

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

AC Immune DC Track Circuits – Set-Up, Test and Certification

SES 02

Applicability

New South Wales	✓	**RIC (NSW CRN)**	✓

Primary Source

RIC Standard SC 07 41 00 02 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 DC Track Circuit History Card to ESI-07-03 and updated references. Transferred document to new template and edited for grammar and style.

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About This Standard

This document describes the procedures for the putting into operation, testing and certification of an AC Immune DC track circuit equipped with a 9 ohm BRB 966F2 DC track 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.

1 Initial Set-Up

Initial set-up 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.

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 the 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 Equipment Check

Check that the track feed set is correctly installed, with the output range jumper set to low output, that surge protection is installed and the correct arrestors are fitted, and that all screw terminals on fuses and links are properly tightened.

1.5 Power Up – Feed End

Close outgoing cable links and track feed set 120 volt supply fuse and link.

Check that track polarity is the reverse of the previous DC track. If not, then reverse the connections between the feed set and track connections.

1.6 Rail Connections Check

Using a suitable digital meter, measure the DC millivolts drop on each track connection between the cable core (or the crimp lug, if the core is not accessible) and the rail head. Each connection should read 1 millivolt or less. If any connection is over 5 millivolts it should be retightened. If this is not successful, the connection should be removed, cleaned and reconnected to achieve the low millivolt drop.

1.7 Power Up – Relay End

Check that surge protection is wired and the correct arrestor is fitted.

Close the incoming relay fuse and link.

Observe that the relay energises. If the relay does not pick up, or picks up only weakly, increase the feed set output.

Note: The upper limit to the permissible relay energisation is the 3 watt coil dissipation limit. (This is equivalent to about 5.2 volts on the 9 ohm relay.)

1.8 Shunt and Correspondence Check

Using a fixed 0.5~ shunt 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 covers the adjustment of the track feed set to achieve the specified relay operating values.

2.1 Initial Relay Check

Measure that the relay control voltage is above 150 per cent of the compression voltage recorded on the relay test label. If it is less than this, set the feed set output to the High output setting.

2.2 Drop Shunt Check and Final Adjustment

Measure and note the relay control volts.

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

The drop shunt measured should be greater than 0.5 ohms. A final drop shunt value between 150 per cent and 200 per cent of the minimum is acceptable.

Notes:

- *The relay is de-energised when all front contacts can be seen open.*
- *There is no provision for the adjustment of AC Immune DC track circuits, other than the High/Low output tappings. The track circuit is designed to operate effectively over a wide range of length and ballast conditions.*

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 DC 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.

Note: With DC track circuits of all types, it is possible to encounter the phenomenon of 'battery effect'. A voltage is generated between the rails by chemical/electrolytic interaction between the rails and the ballast. If a residual voltage is found, prove that it is not a false feed by observing that it remains when all adjacent DC track feeds are disconnected. Battery effect voltages are also seen to drop gradually to zero after the track feed is disconnected, and have a drop shunt of several ohms.

3.2 Check Polarity Reversal

Check that correct polarity reversal occurs at each block joint where another DC track circuit abuts.

3.3 Test Shunt

Test shunt the track using a 0.5 ohm fixed shunt. 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.

3.4 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: Explanatory Notes

Note 1: Track Circuit Polarity Check

With DC track circuits, it is critical that at any interface between a pair of tracks, the polarity of one track is opposite to the polarity 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 if unavoidable, at an interface where two feed ends abut.

Note 2: Track Connection Resistance

It is critical that the rail terminations of track connection cables are as low resistance as possible. As a guide, the voltages to be expected on good new connections should be less than 2 mV.

Measure the 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 leads 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-02 DC Track Circuit History Card is available on the ARTC Engineering Extranet.