



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Signalling)

Category: Standard

# DC Track Circuits – Set-Up, Test and Certification

## SES 01

### Applicability

|                 |   |                |   |
|-----------------|---|----------------|---|
| New South Wales | ✓ | CRIA (NSW CRN) | ✓ |
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| 1.3     | 11 June 2010     |        | 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 standard DC track circuits and DC tracks using the BRB style TR17 track feed set, in a typical ARTC installation. The commissioning of AC immune DC track circuits is described in a separate procedure.

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 to remove 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 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, surge protection is installed, the correct arrestors are fitted and that all screw terminals on fuses and links are properly tightened.

Check that the feed resistor is adjusted to mid-range. On the TR17 feed set, check that the output adjustment is set for the low output.

If the track feed uses primary cells, check that these are prepared and filled in accordance with the manufacturer's instructions.

#### 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, reverse the connections between the feed set and the track connections.

#### 1.6 Rail Connections Check

Check that all rail connections are securely tightened.

## 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 weakly, increase the relay voltage by decreasing the feed resistor, placing the primary cells in series or increasing the feed set output.

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*Note: When using the TR17 feed set, the upper limit to the permissible relay energisation is the 3 watt coil dissipation limit. (This is equivalent of about 3.4 volts on a 4 ohm relay.)*

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## 1.8 Shunt and Correspondence Check

Check that the track shunts correctly by applying a fixed shunt at the relay end and observing that the relay de-energises. For a standard DC track circuit, the shunt resistance is 0.1 and for the TR17 type; 0.5.

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

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, increase the track feed as required.

If a TR17 style feed set is used, the relay voltage should be above 150 per cent. 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 at the relay end of the track, connected two metres outside the relay end track connections.

The drop shunt measured should be greater than 0.1 for a standard DC track and over 0.5 for the TR17 style of track circuit. A final drop shunt value between 150 and 200 per cent of the minimum is acceptable. If necessary, adjust the feed voltage using the feed resistance to obtain the necessary drop shunt.

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*Notes:*

- *The relay is de-energised when all front contacts can be seen open.*
  - *There is no provision for adjustment of TR17 style 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.*
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## 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.

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*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.*

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### 3.2 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 either a 0.1 or 0.5 fixed shunt (depending on the type of track circuit). 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 the ESI0703F-02 DC Track Circuit History Card for all tracks. 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.

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*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.*

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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.