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Technical Note - TN 083: 2016

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Subject: Withdrawal of legacy RailCorp signalling set to work manuals

This technical note is issued by the Asset Standards Authority (ASA) to notify that the following legacy RailCorp signalling set to work manuals have been withdrawn:

- TMG 1350 *DC Track Circuits – Set Up, Test and Certification*, version 1.1
- TMG 1351 *AC Immune DC Track Circuits – Set Up, Test and Certification*, version 1.1
- TMG 1352 *Jeumont-Schneider Impulse Track Circuits – Set Up and Adjustment Procedure*, version 1.2
- TMG 1353 *AC Single Rail Track Circuits – Set Up, Test and Certification*, version 1.1
- TMG 1354 *AC Double Rail Track Circuits – Set Up, Test and Certification*, version 1.1
- TMG 1355 *CSEE UM71 AF Jointless Track Circuits – Set Up, Test and Certification*, version 1.1
- TMG 1356 *WBS FS2500 AF Jointless Track Circuits – Set Up, Test and Certification*, version 1.1
- TMG 1357 *ML TI21 AF Jointless Track Circuits - Set Up, Test and Certification*, version 1.1

Note: All enquiries regarding the technical content of the manuals listed in this technical note should be directed to SydneyTrainsstandards@transport.nsw.gov.au.

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Engineering Manual

TMG 1351

AC IMMUNE DC TRACK CIRCUITS SET UP, TEST AND CERTIFICATION

Version 1.1

Issued March 2013

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Document control

Version	Date	Summary of change
1.0	21/08/2007	Replaced *SC 07 41 00 02 WI AC Immune DC Track Circuits – Set Up, Test and Certification Procedure – v2.0* of July 2001. New RailCorp format
1.1	March 2013	Application of *TMA 400* format

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1 Introduction

This instruction describes step-by-step procedures for the putting into operation, testing and certification of an AC immune single rail track circuit equipped with a 9 ohm BRB 966F2 DC track relay, in a typical RailCorp 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.

The commissioning procedure is described in two stages. Firstly, there are the set-to-work activities, by which the new track circuit is made operational. This is followed by the test and certification phase, when finally adjustments and checks are carried out to ensure that the track circuit is operating correctly and safely. When there are only a few track circuits to be commissioned, the duties can be carried out by a combined team. All care must be taken then, that none of the necessary checks and tests specified in this document are omitted.

Before proceeding with the testing and commissioning of AC Immune DC Track Circuits, persons not familiar with their operation are advised to read Appendix B, which gives a concise description of the equipment operating principles and hardware.

2 Initial Set-up

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

2.1 Equipment

- Fluke multimeter, any model
- Fixed test shunt 0.5 ohms
- RSA spanner
- Two-way radios - one per person
- Track Insulation plan
- Track Circuit Commissioning Master Sheet

2.2 Clear old track connections

Where an existing signalling system is being renewed, the first step is the removal of all old, redundant track circuit feed and relay connections.

2.3 Bonding

Bond out all redundant insulated joints, remove any temporary bonds around new insulated joints, connect any new parallel and series bonds.

Check that all mechanical joints are bonded out (using 2x Cadweld or GI bonds)

2.4 Make new connections

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

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Check that track feed and relay cables are correctly terminated, with twin 6mm2 cables to each rail.

Check that connections in bootleg risers are made, and links closed.

2.5 Check bonding and connections

Walk length of track circuit, checking track against the new track insulation plans. Check that all bonding and connections are complete, and that no extra rail connections are left.

Check that no other metalwork is connected to track - bridges, steel frames over culverts or cattle grids.

2.6 Equipment check

Check that track feed set is correctly installed, with output range jumper set to 'low' output.

Check that surge protection is installed and correct arrestors fitted.

Check that all screw terminals on fuses and links are properly tightened.

2.7 Power-up - Feed End

Close outgoing cable links.

Close track feed set 120 volt supply fuse and link.

Measure feed end rail volts.

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

2.8 Rail connections check

Using a Fluke 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. If the set-to-work team is unable to carry out this task, then the problem should be reported to the commissioning control to be logged for cleaning and reconnection.

2.9 Power-Up - Relay End

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

Close incoming relay fuse and link.

Observe that the relay energises. In the unlikely case that the relay does not pick up, or picks up only weakly, it may be necessary to increase the feed set output tap.

Note: There is no upper limit to the permissible relay energisation, other than the 3 watt coil dissipation limit. (This is equivalent to about 5.2 volts on the 9 ohm relay.)

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2.10 Shunt check

Check that the track shunts correctly by applying a fixed 0.5 ohm shunt at the relay end, and observe that the relay de-energises.

2.11 Documentation Check

Check that all 'set to work' activities on the commissioning master sheet have been completed satisfactorily, and all test values measured and recorded.

2.12 Notify Commissioning Headquarters

As soon as possible after each track is completed, advise the commissioning control centre so that the log can be updated.

3 Final Adjustment and Measurement

Final adjustment details the adjustment activities carried out by the test-and-certify team. It covers the adjustment of the track feed set to achieve the specified relay operating values.

The test-and-certify team is responsible for the preparation of track history cards for all tracks commissioned. These should be completed at the end of the day, using the data recorded on the commissioning master sheets prepared by the set-to-work and test-and-certify teams.

3.1 Equipment

The following is the minimum equipment required by the test-and-certify team:

- Fluke multimeter, any model. Used for voltage measurements, and resistance measurement on variable drop-shunt
- Variable shunt unit complete with track clips, 0-4 ohms, for drop-shunt measurement (or 0.1 ohm to 10 ohm decade shunt box)
- Fixed test shunt, complete with track clips.
- RSA spanner
- Two-way radios - one per person
- Track Insulation plan
- Track Circuit Test and Certify Master Sheet
- Clipboard and pens.

3.2 Staffing

The normal staff requirement is two persons, one an engineer fully competent to adjust, test and certify DC tracks, and the second with some experience in track circuit testing, and some familiarity with DC track circuit equipment.

For optimum efficiency, the team should have two fully competent members, each equipped with a Fluke or similar meter.

3.3 Initial relay check

Measure that the relay control voltage is above 150% 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.

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3.4 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. Starting at a maximum resistance value, reduce the shunt resistor until the relay de-energises. Note the shunt resistance value that achieves this.

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

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

Note: There is no provision for 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.

3.5 Standard values check

Measure and record all equipment data and voltages listed, on the master commissioning sheet (a copy of the master sheet is given in Appendix 2)

The 'control volts when shunted' value is taken either while the track is shunted with the correct value fixed shunt near the relay end, or while the track is actually occupied by a train.

4 Certification

Certification details the final activities carried out by the test-and-certify team. It covers the proving of correct operation of the track circuit, and the completion of all documentation activities.

4.1 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% 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: Battery Effect

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.

4.2 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:

2m from the feed end rail connections

Mid-track

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At both ends of any parallel-bonded section of track (where points are involved)

2m from the Relay end rail connections

Note the successful completion of all test shunts, on the commissioning master sheet.

4.3 Communicating results

As soon as possible after each track is completed, advise the commissioning control centre so that the log can be updated.

If any problem is found with the track, notify the commissioning control centre as soon as possible. If the problem does not interfere with completion of track testing, continue. If the problem does preclude immediate completion of testing, then proceed to the next track and return when corrections have been carried out.

4.4 History cards

When all track work is complete, use the details recorded on the commissioning master sheet to fill in individual history cards for all tracks tested by the team. The cards are signed by the responsible RailCorp member of the team.

4.5 Final Documentation

Where special documentation is provided for the recording of commissioning activities, ensure that the track testing records are completed and signed for all tracks tested by the team.

Ensure that all defects or problems encountered are recorded in the commissioning log.

Ensure that the numbers of all tracks completed, and of all tracks allocated to the team but not completed by the team, for whatever reason, are recorded either in the test records or the commissioning log.

Ensure that the handing-over of completed commissioning master sheets and track circuit history cards is recorded in the commissioning log.

4.6 Sign off and leave site

End of Procedure

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Appendix A 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 blockjoints 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.

To check track polarity reversal between two single-rail track circuits, measure the voltages on the signalling rail, from either side of the blockjoint to the common traction rail, and the voltage directly across the blockjoint on the same rail. If the tracks are correctly polarised, the sum of two track circuit voltages will equal the voltage across the joint; if the measured value is equal to the difference of the voltages, then the tracks are not correctly phased and corrective action needs to be taken.

Where there are insulated joints in both rails, this check should be carried out twice, with first one, then with the other insulated joint short-circuited.

Note 2: Track Connection Resistance

It is critical that the rail terminations of track connection cables are as low-resistance as possible, to ensure reliable operation of the track circuit.

An effective indication of the quality of each connection is obtained by measuring the voltage drop in millivolts between the connecting cable and the head of the rail near the termination (if the cable conductors are not accessible, then measure from a point on the cable lug nearest the cable.)

Any reading over 5mv should be taken to indicate a suspect connection, and the tightness of nuts checked. If this does not improve the connection resistance, it may be necessary to remove the bolt, and clean the hole with a round file or abrasive, before reconnecting and tightening up.

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Appendix B Operating Principles and Hardware

Description of Track Circuit

AC Immune DC track circuits are designed for use in 25kV AC electrified areas, or in non-electrified areas proposed for future AC electrification. They operate in a single-rail traction return arrangement, and are designed to be immune to interference and damage arising from AC traction return currents. They comply with BRB Specification 867, and use relays complying with BRB 966F2. Both feed set and relay are immune to up to 1000V at 50Hz, applied across the output or relay terminals respectively.

The normal maximum track circuit length is 500 metres. This limit is set by the maximum longitudinal AC voltage drop permitted under traction fault conditions.

Minimum drop shunt is 0.5 ohms.

Operation

The track circuit comprises a feed set (which occupies the rack space of 4 BRB relays), and the track relay.

The feed set includes a transformer, rectifier and feed resistance; no external resistance is required. The AC immunity of the feed set is provided by a low-pass output filter, and special arrangements to limit the DC effects of any AC voltage impressed on the output terminals.

There is only a single output adjustment on the feed set. This provides two settings, 'Low' for normal ballast, and 'High' for very poor ballast (less than 3 ohms). In almost all cases, the 'Low' output gives satisfactory operation.

The normal track relay voltages produced are much higher than found with normal DC track circuits (3 to 4 volts is not unusual). This is not a matter of concern; the relay is designed to operate without degradation so long as its thermal dissipation limits are not exceeded, and the drop-shunt value is assured by the high feed resistance value used.

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