AUSTRALIAN RAIL TRACK CORPORATION LTD

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

ML TI21 AF Jointless Track Circuits – Set Up, Test and Certification

SES 08

Applicability

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

Primary Source

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Amendment Record

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1.1	1 September 2004		Reformatting to ARTC standard.
1.2	14 March 2005	Disclaimer	Minor editorial change. Footer reformatted.
1.3	18 June 2010	Various	Transferred Type ABB ML TI21 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 activities required for commissioning and certifying ABB/ML type TI21 audio frequency jointless track circuits, 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 Set to Work

This section covers the removal of any old track circuit equipment and the connection and powering up of the new equipment.

1.1 Bonding and Track Connections

Where an existing signalling system is being renewed, ensure that all old, redundant track circuit connections, including old feed and relay connections, impedance bonds and spark¬ gap connections are removed.

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

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

Walk the length of the track circuit, checking the track against the new track insulation plans. Check that all bonding and connections are complete, that spark gap connections are to the correct rails, that no extra rail connections are left and that there are no spark gap or auxiliary equipment connections within the tuned loops.

1.2 Check Auxiliary Track Equipment

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

1.3 Equipment Check

Check that all tuning units, transmitters and receivers are of the correct frequency and type.

Check that matching unit strapping is correct for the transmitter or receiver and that SI units are correctly installed. Where the track circuit terminates on an impedance bond, check that cables from the matching unit are correctly terminated

Check that all lightning protection and earthing at locations and matching units is installed and correctly terminated.

Check that all rail connections and location terminal connections are made and properly tightened.

Check that any resonated impedance bonds are preset to the required initial value, listed in Appendix 1: Technical Notes, Note 1.

1.4 Transmitter and Receiver Initial Settings

Check that the transmitter power output is set correctly for the length of track circuit by selecting the appropriate transmitter tuning unit input terminals.

Tracks up to 250 metres: Low power

Tracks over 400 metres: High power

Check that the receiver gain straps are preset

Tracks up to 400 metres: Gain = 7

Tracks over 400 metres: Gain = 13

1.5 Power Up

Insert fuses and links to power up the transmitter and receiver. Observe that the transmitter makes the correct warbling tone and that the relay energises.

Measure the transmitter and receiver B24 supply voltages.

1.6 Check Rail Connections

Using a suitable digital meter, measure the 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 Compensated Tracks

Check that capacitors are evenly spaced at 200 metre intervals (estimated), that capacitors are of the correct value (see below), that all capacitor connections are tight, that capacitor cables are clipped to the foot of the rail and that each capacitor is secured to a sleeper, flush with the sleeper top.

Capacitor Values

HF (or 22uF) for track frequencies 2600 and 2300, LF (or 33uF) for track frequencies 2000 and 1700.

1.8 Shunt and Correspondence Check

Using a fixed 0.15 ohm shunt applied outside the tuned loop 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, observe the correspondence of the diagram indication to the track circuit as part of this shunt check.

2 Final Adjustment

Final adjustment covers the adjustment of impedance bonds and the setting of receiver gain to achieve the specified drop shunt value.

2.1 Equipment

A frequency selective voltmeter (ML, VS19 or frequency selective adapter used with a digital multimeter) is necessary for all track and receiver voltage measurements.

2.2 Resonated Impedance Bonds

Identify any resonated impedance bond installed on the track circuit.

With Jeumont Schneider bonds, set the resonating capacitor connections as shown in the CSEE manual.

On WB&S and Macolo resonated bonds, set the resonating capacitor initially to the values shown in Appendix 1: Technical Notes, Note 1. If necessary, adjust the resonating capacitance to achieve a maximum voltage across the capacitor, but not exceeding 400 volts. Capacitor voltage can range from 35 volts up to over 400 volts, depending on track length and the position of the bond.

On tracks less than 400 metres in length, it is normally satisfactory and preferable to leave the bond unresonated, with the capacitor terminals left open.

2.3 Drop Shunt Measurement and Receiver Adjustment

Measure and record the drop shunt of the track using a variable shunt unit at the relay end of the track, connected outside the tuned loop at the receiver end rail connections.

The drop shunt should be as close as possible to 1 w. Adjust the receiver gain to obtain a final drop shunt value between 0.8 and 1.2. Leave the gain set at the value which results in a drop shunt nearest to 1. Record the final gain and drop shunt values.

For tracks with low range gains, each gain step will produce a large change in drop shunt and it may not be possible to achieve a drop shunt value closer than 0.7 or 1.3. In that case choose the upper value.

2.4 Intermediate Receiver (DPU)

Each intermediate receiver should be treated as a separate track circuit; sharing a common transmitter end with its parent track. A separate history card should be completed for each intermediate receiver.

Final adjustment of the intermediate receiver should be carried out after the parent track is finally adjusted. The procedure for this is described in Appendix 1: Technical Notes.

Note: If it is necessary to adjust the transmitter level to obtain correct adjustment of the intermediate receiver, then it will be necessary also to readjust the parent track receiver.

3 Certification

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

3.1 Zero Feed Receiver Voltage

With all adjacent tracks operating, disconnect the feed from the track under test and with the selective voltmeter, measure the voltage on the receiver input terminals (R1/R2).

If the remaining voltage exceeds 30 per cent of the receiver 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 the 0.15 ohm fixed shunt. Sets of three shunts should be made at the following points, at least:

- three metres inside the Tx tuned loop two metres outside the Tx tuned loop
- mid track
- at both ends of any parallel bonded section of track (where points are involved)
- two metres outside the Rx tuned loop three metres inside the Rx tuned loop

3.3 History Cards

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

4 Appendix 1: Technical Notes

Note 1: Resonated Impedance Bonds – Initial Capacitor Settings (WB&S 2000R/AF)

The following table provides initial values to which a WB&S 2000R/AF resonated impedance bond should be preset to ensure operation of the track circuit when initially powered up. The final resonation of the bond should be done as part of the final adjustment of the track circuit.

Track Frequency	Capacitor (nF)
1700	26.8
2000	22.5
2300	20.0
2600	17.8

Note 2: Intermediate Receiver (IRx) Adjustment Sequence

The final adjustment of the intermediate receiver should be carried out after the parent track is finally adjusted.

Note: If it is necessary to adjust the transmitter level to obtain correct adjustment of the intermediate receiver, then it will be necessary also to readjust the parent track receiver.

IRx Amplifier Adjustment

Measure the receiver input current from the intermediate receiver selective amplifier. If necessary, adjust the amplifier attenuator until the receiver input current is between 30 mA and 50 mA.

IRx Drop Shunt and Final Adjustment

Measure the IRx drop shunt at a point one metre on the transmitter side of the IRx pickup units. Adjust the IRx receiver gain (and amplifier attenuator, if necessary) to obtain a drop shunt between 0.8 and 1.

Note 3: 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.

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, then clean all mating surfaces with abrasive or solvent as required, reassemble and tighten carefully.

5 Appendix 2: Track Circuit History Card

The ESI0703F-04 Type ABB ML TI21 Track Circuit History Card is available on the ARTC Engineering Extranet.

6 Appendix 3: Adjustment of Intermediate Receiver (DPU)