AUSTRALIAN RAIL TRACK CORPORATION LTD

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

CSEE UM71 AF Jointless Track Circuits – Set-up, Test and Certification

SES 06

Applicability

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

Primary Source

RIC Standard SC 07 44 01 00 WI version 2.0

Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.3	06 August 2010	Standards	Manager Standards	Exec Manager SS&P 12/08/2010	CEO

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.1	01 September 2004		Reformatting to ARTC Standard
1.2	14 March 2005	Disclaimer	Minor editorial change. Footer reformatted.
1.3	06 August 2010		Transferred Track Circuit History Cards to ESI-07-03 and updated references. Transferred document to new template.

Contents

About This Standard

This procedure describes the activities involved in commissioning and certifying CSEE UM71 (Type T1) 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 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 sparkgap connections, are removed.

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

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

Walk length of track circuit, checking track against the new track insulation plans. Check that all bonding and connections are complete, that spark-gaps connections are to the correct rails, and 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 have 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 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, Note 1.

1.4 Transmitter & Receiver Settings

Check that the transmitter output level (Kem) is set correctly for the transmitter frequency, and that the modulation strap M 1/M3 is fitted.

Check that the receiver Krv straps are pre-set

Tracks up to 400 metres: Krv = 20

Tracks over 400 metres: Krv = 30

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 achieved the low millivolt drop.

1.7 Compensated tracks

Check that capacitors are evenly spaced at 100 metre intervals (estimated), that capacitors are of correct value (see below), that all capacitor connections are tight, 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 use with 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, 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 Receiver adjustment

Measure the receiver input reference voltage on receiver terminals R1/R2.

Adjust the Krv ratio (receiver gain) straps if necessary, to obtain a voltage across R1/R2 between 320 and 350 mV. (For adjustment method, see Appendix 1, Note 2)

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. It should be recorded individually on the commissioning master sheets, and have a separate history card completed for it.

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 3.

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 60 mV (30% 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 Drop-Shunt check

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.

3.3 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:

3m inside the Tx tuned loop 2m outside the Tx tuned loop Mid-track

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

2m outside the Rx tuned loop 3m inside the Rx tuned loop

3.4 History cards

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

4 Appendix 1 - Technical Notes

Note 1: Resonated Impedance Bonds- Initial capacitor settings (WB&S 2000R/AF)

This table gives 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: Adjustment of Krv ratio

This adjustment sets the input sensitivity of the receiver. It is critical that it is not set higher than necessary - at extreme settings it may be possible to set the receiver so that the track will not shunt when occupied.

Begin by measuring the voltage on receiver terminal R1/R2. If this is in range the 320 - 350 mV then the adjustment is correct, and the relay should be up.

If R1/R2 volts are outside this range:

a) -check Krv setting by inspecting the existing gain strapping and referring to Krv tables

b) -if R1/R2 volts are high, select and set a lower Krv setting; vice versa if R1/R2 volts are low

c) -measure R1/R2 volts, and repeat step 'b' until it lies within range (if track is wet, aim for the lower end of the range; if very dry, aim for the upper limit)

If the track has been commissioned during wet weather or soon after, commissioning staff must advise maintenance staff of the need to retest the track regularly as conditions dry out, and to adjust the Krv downwards as necessary to maintain the R1/R2 voltage within the required limits.

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 2mV.

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 that, 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 5mV 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, reassemble and tighten carefully.

5 Appendix 2 - Track Circuit History Card

The ESI0703F-07 CSEE Type UM71 Track Circuit History Card is available on the ARTC Engineering Extranet.

6 Appendix 3 - Adjustment of Intermediate Receiver (DPU)

This section not yet published