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About This Standard

This Specification describes the general requirements for Impedance Bonds rated at 1000A/Rail and 2000A/Rail to be manufactured and supplied to Australian Rail Track Corporation of NSW (ARTC) for Signalling applications.

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Contents

1.	Introduction.....	6
2.	Referenced Documents.....	6
2.1.	Australian Standards	6
2.2.	International Standards	6
3.	Construction	6
4.	Physical Characteristics.....	6
4.1.	Dimensions and Mounting	6
4.2.	Covers.....	6
5.	Electrical Characteristics	7
5.1.	Ratings.....	7
5.2.	High Voltage Breakdown Test	7
5.3.	Insulation Resistance Test.....	7
6.	Performance Characteristics	7
6.1.	Current and Heat Rise.....	7
6.1.1	Heat Rise.....	7
6.1.2	Insulation Class	8
6.2.	Unbalance Currents.....	8
6.3.	Resonated Impedance Bonds	8
7.	Mechanical Requirements	8
7.1.	Traction Connections.....	8
7.1.1	Traction Terminals	8
7.1.2	Other Terminals	8
7.2.	Lugs	9
8.	Environmental	9
9.	Information to be Furnished by the Supplier	9
10.	Labelling.....	10
11.	Packaging and Delivery.....	10
12.	Appendix A - Information to be furnished by the Supplier	11

1. Introduction

This Specification describes the general requirements for Impedance Bonds rated at 1000A/Rail and 2000A/Rail to be manufactured and supplied to Australian Rail Track Corporation of NSW (ARTC) for Signalling applications.

This device permits traction return currents, whilst maintaining the operation of track circuits (by-passes insulated block joints in case of double rail track circuit signalling)

2. Referenced Documents

2.1. Australian Standards

AS 1099.2Z/AD-1980: Composite temperature/Humidity cyclic test

AS 1099.2.6 -1988 : Test Fc-Vibration (sinusoidal)

AS 1099.2.77-1988 : Test Ea-Shock

2.2. International Standards

This Specification refers to the following international Specifications and Standards:

AAR, Part 67 - Specification for Impedance Bonds

BS 863/1988 - Impedance Bonds for use with 50Hz Double Rail Track Circuits and Audio Frequency Track Circuits

3. Construction

Impedance Bonds shall be constructed in accordance with the following Physical, Electrical, Mechanical and Performance Characteristics, environmental conditions, etc.

4. Physical Characteristics

4.1. Dimensions and Mounting

The maximum height (above the mounting plate) of the Impedance Bond for mid-track mounting shall not exceed 150mm.

The Impedance Bond shall be mounted on two Rail Sleepers for mid-Track mounting, and shall be mounted horizontally or vertically on a steel frame for off-track mounting.

4.2. Covers

The covers of Impedance Bonds shall be strong enough to withstand environmental conditions and ramped at the ends to avoid any damage from dragging equipment.

Traction terminals shall be accessible without removing the covers. Other terminals shall be protected by removable covers. Covers shall be of silver-grey colour or galvanized finish.

5. Electrical Characteristics

5.1. Ratings

The ratings of the Impedance Bonds shall be in accordance with the Table below:

Type	Continuous Current Rating/Leg	DC Resistance @ 20C	AC Impedance @ 20C
Non resonated 1000A/Rail	1000	mOhm	>0.5 ohm @ 0.5V 50Hz
Impulse TC 1000A / Rail	1000A	0.6 mOhm	>0.18 ohm @ 0.5V 50Hz
Impulse TC 2000A ;/ Rail	2000A	0.3 mOhm	>0.18 ohm @ 0.5V 50Hz
50Hz Resonated 2000A / Rail	2000A	0.3 mOhm	>1.5 ohm @0.5V 50hz
AF Resonated 2000A / Rail	2000A	0.3 mOhm	>15 Ohm at operating frequencies

5.2. High Voltage Breakdown Test

A voltage of 2 KV AC, 50Hz shall be applied for one minute between windings and frame without breakdown. Insulation Resistance test shall be performed at the end of this test.

5.3. Insulation Resistance Test

The insulation resistance measured between the Terminals and the Frame shall record as follows when measured with a 500V Megger:

Terminals of Primary Winding and Frame	>100 M-Ohm
Terminals of Secondary Winding and Frame	>100 M-Ohm
Terminals of Primary and Secondary Windings	>100 M-Ohm

6. Performance Characteristics

6.1. Current and Heat Rise

Impedance Bonds shall withstand twice the rated current for a period of 10 minute and repeated at every 30 minute intervals at the ambient temperature 45 C.

6.1.1 Heat Rise

The Temperature rise at the rated load and at the ambient temperature of 45 C shall

not exceed 100C on the internal winding of the Impedance Bond.

6.1.2 Insulation Class

The Insulation Class shall be such that it shall maintain insulating properties at 150C.

6.2. Unbalance Currents

The AC Impedance (at operating frequencies) shall not decrease by more than 10% with an out of balance current in one half of the winding exceeding that in the other half by the margin of 12% of the full continuous rated current.

The AC Impedance (at operating frequencies) shall decrease by more than 50% with an out of balance current in one half of the winding exceeding that in the other half by the margin of 25% of the full continuous rated current.

6.3. Resonated Impedance Bonds

Resonated-Impedance Bonds shall be incorporated with a Capacitance box, by which the resonance condition of the Impedance Bond be achieved.

The Capacitors in the box shall be rated at 400V or higher.

The capacitance unit shall be provided with appropriate surge voltage protection. This Capacitance Box shall meet Environmental Protection Class IP67.

The adjustment of capacitance for resonance shall be possible while the Impedance Bond is in circuit, without risk of electrical shock to personnel.

7. Mechanical Requirements

7.1. Traction Connections

7.1.1 Traction Terminals

Impedance Bond side leads shall each provide for the connection of 2 lugs side by side. (The lugs are described in paragraph 7.2 below).

Neutral point connection shall accommodate 4 lugs of the same type. For termination of lugs 13mm holes shall be provided.

Hardware for termination of traction lugs shall be hex-headed bolts, each provided with 2 flat washers, lock washer, nut and lock nut. All termination hardware shall be stainless steel.

Impedance Bonds shall be provided with 12 sets of M12 hardware.

The mounting hardware for each Impedance Bond shall be packed in a canvas or equivalent bag, firmly attached to the bond.

7.1.2 Other Terminals

Terminals other than traction terminals shall be fixed studs of Stainless Steel or Nickel plated Brass and preferably of M6 diameter.

Each stud shall be fitted with at least 2 flat washers and 2 nuts, in addition to any provided to terminate existing permanent connections on the stud.

7.2. Lugs

Traction Return Bond cables shall be terminated on individual lugs as specified in Specification SPS 33 “Solderless Cable Lugs, Pins and Sleeves”.

Where the design of the Impedance Bond requires an alternative design of Lug, and impedance bond shall be provided with the required amount of Lugs for connections plus 50% as spares. These Lugs shall be packaged with each individual Impedance Bond along with the other hardware.

8. Environmental

Impedance Bonds shall operate satisfactorily under the following environmental conditions.

Direct exposure to Rain, Dust, Ultra-Violet Radiation, complete immersion in water, etc.

Temperature: -10 to +70 C

Humidity: Relative Humidity 0 to 100%

Tests shall be done in accordance with AS 1099.2Z/AD-1980 (Composite temperature/Humidity cyclic test)

Vibration: Frequency -5 to 200Hz

Acceleration 1.0g

No. of sweep cycles 20

The Impedance Bonds shall operate satisfactorily subject to a sinusoidal vibration applied along each of the 3 mutually perpendicular axes.

Tests shall be performed in accordance with AS 1099 2.6 - 1988 {Test Fc-Vibration (Sinusoidal)}

Conditions of these tests are subject to review if facilities of tests are not available or not practicable, in which case field testing shall be acceptable.

Shock: Acceleration 15g

Duration 11mS

No. of sweep cycles 20

Pulse shape Final-peak saw-tooth

Tests shall be performed in accordance with AS 1099 2.27 - 1988 (Test Ea - Shock)

9. Information to be Furnished by the Supplier

Potential Suppliers shall submit the completed schedule in Appendix A with their offers.

Complete technical information of Impedance bond electrical characteristics shall be forwarded by the supplier with the following performance characteristics curves:

1. Heat rise v/s % (Impedance out of balance)
2. AC voltage v/s % (Impedance out of balance)

10. Labelling

Metal labels with the information listed below shall be provided and fastened on the Impedance Bond:

- Impedance Bond (type)
- Rating (A/Rail)
- Supplier Name or identity
- Model number
- Month and Year of Manufacture
- Serial number

11. Packaging and Delivery

All Impedance Bonds shall be delivered securely strapped to pallets or in crates, complete with all fittings and/or Lugs.

12. Appendix A - Information to be furnished by the Supplier

- Type of Impedance Bond
- Continuous Rating
- Impedance Bond Intermittent Rating
- Model No
- Catalogue No
- Maximum Duty Time @ 200% of rated current
- Maximum Duty Time @ Maximum Intermittent Rating
- Method of Cooling
- The AC Impedance (@ 0.5V 50Hz/@ 5V 50Hz)
- Resistance of Traction Winding
- The AC Impedance when out of balance current equal to 12% Maximum Rating
- The AC Impedance when out of balance current equal to 25% Maximum Rating
- Type of Winding Method
- Heat Rise @ full rating in ambient of 50 C
- Weight of Bond
- Finish on Bond (Eg. galvanised)
- Dimensions (Length x Width x Height)
- Height above mounting base
- Number of Mounting Holes Front Back
- Mounting Hole sizes
- Centres for Mounting Holes Length Width
- Number of Neutral Points for Cable Connections
- Have terminals been provided for Track Connection
- Cable Lug Part No and Manufacturer (If different from specification)
- Maximum size of cable to fit terminal (bore-hole) (If different from specification)
- Crimp tool to be used for crimping lug (If different from specification).
- Die for crimping tool (If different from specification)
- Bolt size required for securing (palm-hole) (If different from specification)
- Other deviations from the specification?