

NZECF 60:1997

ISSN 0114-0663

COVER PAGE

NZEC 60:1997

NEW ZEALAND ELECTRICAL CODE OF PRACTICE

for

INSPECTION, TESTING AND CERTIFICATION

of

LOW VOLTAGE A.C. RAILWAY SIGNALLING CONTROL CIRCUITS

Issued by the Office of
The Chief Electrical Engineer,
Operations and Risk Management Branch,
Ministry of Commerce,
Wellington, New Zealand

THE ELECTRICITY ACT 1992

Approval of the New Zealand Electrical Code of Practice for Inspection, Testing and Certification of Low Voltage A.C. Railway Signalling Control Circuits 1997 (*NZECF 60:1997*)

Pursuant to section 38 of the Electricity Act 1992, I, hereby approve the New Zealand Electrical Code of Practice for Inspection, Testing and Certification of Low Voltage A.C. Railway Signalling Control Circuits 1997 (*NZECF 60:1997*).

The New Zealand Electrical Code of Practice for Inspection, Testing and Certification of Low Voltage A.C. Railway Signalling Control Circuits 1997 (*NZECF 60:1997*) was issued by the Secretary of Commerce on the 6th day of November 1997.

Dated this 11th day of March 1998.

Max Bradford
Minister of Energy

COMMITTEE REPRESENTATION

This Code of Practice was prepared by the Ministry of Commerce, Chief Electrical Engineer's Office with reference to the following organisations:

Tranz Rail
South Pacific Inspectors Association
New Zealand Electrical Institute

REVIEW

This Code of Practice will be revised as occasions arise. Suggestions for improvements of this Code are welcome. They should be sent to the Chief Electrical Engineer's Office, Ministry of Commerce, PO Box 1473, WELLINGTON.

CONTENTS

	Page
INTRODUCTION.....	1
SECTION 1	
SCOPE, APPLICATION, INTERPRETATION, GLOSSARY AND NUMBERING	
1.1 SCOPE	2
1.2 APPLICATION.....	2
1.3 INTERPRETATION.....	2
1.4 GLOSSARY OF ABBREVIATIONS USED IN THIS CODE	3
1.5 NUMBERING SYSTEM OF THIS CODE.....	3
SECTION 2	
SAFETY REQUIREMENTS	
2.1 GENERAL	5
SECTION 3	
INSPECTION REQUIREMENTS	
3.1 EXISTING RAILWAY SIGNALLING INSTALLATIONS.....	6
3.2 INSPECTION	6
SECTION 4	
TESTING REQUIREMENTS	
4.1 GENERAL	8
4.2 INSULATION RESISTANCE TESTING.....	8
4.3 EARTH CONTINUITY TESTS FOR SURGE PROTECTION FITTINGS	9
4.4 TRANSFORMER TESTS	9
SECTION 5	
CERTIFICATION REQUIREMENTS	
5.1 GENERAL	10
APPENDICES	
A1 EXAMPLE FORM OF AN INSPECTION CERTIFICATE FOR EXISTING LOW VOLTAGE A.C. RAILWAY SIGNALLING CIRCUITS	11
A2 EXAMPLE FORM OF AN INSPECTION CERTIFICATE FOR NEW/ALTERED LOW VOLTAGE A.C. RAILWAY SIGNALLING CIRCUITS.....	12
B EXAMPLE FORM OF A TEST CERTIFICATE FOR NEW, ALTERED AND/OR EXISTING LOW VOLTAGE A.C. RAILWAY SIGNALLING CIRCUITS.....	13
C EXAMPLE FORM OF A CERTIFICATION CERTIFICATE FOR LOW VOLTAGE A.C. RAILWAY SIGNALLING CIRCUITS	14

Error! Bookmark not defined.**INTRODUCTION**

Railway signalling control circuits are designed to be earth free so that a single earth fault will not cause the signalling system to fail to a dangerous or less safe condition. They are designed in accordance with International standards and Industry principles.

This Code of Practice is intended for use by persons who have been trained and certified to standards for working on the low voltage A.C. railway signalling circuits and connected fittings.

INSPECTION, TESTING AND CERTIFICATION OF LOW VOLTAGE A.C. RAILWAY SIGNALLING CONTROL CIRCUITS

SECTION 1

SCOPE, APPLICATION, INTERPRETATION, GLOSSARY AND NUMBERING

1.1 SCOPE

This Code specifies the requirements for the inspection and testing for certification purposes of railway signalling installations utilising low voltage A.C. railway signalling control circuit voltages and connected fittings.

1.2 APPLICATION

1.2.1 The inspection and testing of low voltage A.C. railway signalling control circuit voltages and connected fittings shall comply with the requirements of this Code of Practice.

1.2.2 Note that inspection and testing in the following areas, or of the following kinds, also have other Codes that apply to them:

- (a) Caravans and caravan park areas (see NZECP 1);
- (b) Inspection and testing of standard low voltage electrical installations for certification purposes (see NZECP 11);
- (c) Medical locations and associated areas (see NZECP 12);
- (d) Hazardous areas (see NZECP 24);
- (e) Boat marinas and pleasure vessels (see NZECP 29).

1.3 INTERPRETATION

For the purposes of this Code, the definitions below shall apply.

1.3.1 Basic insulation - means the insulation applied to live parts to provide basic protection against electric shock.

1.3.2 Certification - means a statement that the requirements of this Code have been complied with.

1.3.3 Fitting - means (*for the purposes of this Code*) those items which form the termination point for signalling equipment.

1.3.4 Low voltage A.C. railway signalling control circuit voltages (*LVRSCCV*) - means A.C. voltages exceeding 32 V but not exceeding 250 V used to feed railway signalling control circuits and fittings. (*Note this does NOT apply to 230 V MEN systems of supply*)

- 1.3.5 Protective fitting - means a fitting that interrupts the flow of electricity to a circuit or part of a circuit under adverse conditions of over-current, short-circuit, or leakage to earth: and (*without limitation*) includes circuit-breakers, fuses, RCDs, and fault current limiters.
- 1.3.6 Railway - means -
- (a) All land which is held or reputed to be held, or which is under the control of, or under lease, licence or otherwise, or used, in connection with or for the purposes of a rail service licence holder for the purposes of operating a rail service, except where the land is a street or road under the control of a controlling authority and the rail service on it is intended solely for the use of light rail vehicles; and
 - (b) All buildings, erections, wharves, jetties, works, locomotives, carriages, wagons, light rail vehicles, self propelled rail vehicles, motor vehicles, plant, machinery, goods, chattels, and other fixed movable property of every description or kind capable of being used in respect of a railway, and situated on or to be situated on any such land or held or used, or reputed to be held or used, in connection with or for the purpose of operating a rail service; and
 - (c) All signalling systems, warning devices, and radio, telephone, electronic telegraph, or other communication installations used in connection with the operation of a rail service, but not including any traffic signals erected on a street or road by a controlling authority.

1.4 GLOSSARY OF ABBREVIATIONS USED IN THIS CODE

A.C.	Alternating current
LVRSCCV	Low voltage A.C. railway signalling control circuit voltages
NZECP	New Zealand Electrical Code of Practice
RCD	Residual current device
V	Voltage

1.5 NUMBERING SYSTEM OF THIS CODE

- 1.5.1 Sections are numbered 1 to 5.
- 1.5.2 Subsections are numbered by one full stop between numbers (*eg: 1.3*).
- 1.5.3 Clauses are numbered by two full stops between three numbers (*eg: 3.1.2*).
- 1.5.4 Subclauses are numbered by three full stops between four numbers (*eg: 5.1.3.1*).
- 1.5.5 Paragraphs contain numbering punctuated by one or more full stops together with a parenthesised letter.

- 1.5.6 Unless otherwise specified, references in this Code to sections, subsections, clauses, subclauses, paragraphs, are references to those of this Code.

SECTION 2

SAFETY REQUIREMENTS

2.1 GENERAL

Electrical work carried out on railway signalling installations utilising low voltage A.C. railway signalling control circuit voltages and connected fittings shall be inspected and tested to ensure that:

- (a) The signalling installation is secure so that persons are protected against direct and indirect contact with live parts of the signalling installation.
- (b) Persons are protected against injury and property is protected against damage due to excessive temperatures or electromechanical stresses resulting from over-currents likely to arise in the signalling installation.
- (c) Persons are protected against injury and property is protected against harmful effects of faults which could occur by contact between live parts of circuits supplied at LVRSCCV and different voltages.
- (d) Fittings are able to withstand safely the stresses and environmental conditions characteristic of their location by either their design or by the method of their installation.

SECTION 3

INSPECTION REQUIREMENTS

3.1 EXISTING RAILWAY SIGNALLING INSTALLATIONS

When an inspection of an existing railway signalling installation (*see Appendix A1 for Sample Form*) has been carried out under this Code, the inspection shall include checks that:

- (a) Cables show no undue evidence of insulation or sheath deterioration.
- (b) The exposed portion of the earth electrode shows no evidence of corrosion, damage or poor connection of the earthing lead which could adversely affect the integrity of the surge protection fittings.
- (c) Lamp holders have no evidence of mechanical damage or undue evidence of overheating or arcing.
- (d) Fittings have no deterioration of conductor insulation and fuses, terminals and switches show no evidence of mechanical damage.
- (e) Overhead lines carrying LVRSCCV have no undue evidence of insulation deterioration, rusting of anchorages or deterioration of line connection boxes or jointing points.

3.2 INSPECTION

3.2.1 Inspection of work carried out on railway signalling installations (*see Appendix A2 for Sample Form*) shall verify, by examination, that the electrical work meets minimum safety criteria for the connection of the installation to the supply.

3.2.2 Inspection of conductors and fittings shall include checks that:

- (a) Fittings forming part of the installation are not damaged.
- (b) Conductors of cables are correctly identified and are connected to the correct terminals of fittings.
- (c) Conductors are securely held in terminals of fittings and are not subject to tension at the terminations.
- (d) Fittings match the expected load, voltage of the supply and the rating of the protective fitting of the circuit to which the fittings are connected.
- (e) There is adequate insulation and distance between live conductors and live conductors and earth.
- (f) Fittings are adequately supported.
- (g) Fittings are designed for the environment in which they are located or are suitably enclosed.
- (h) No loose conductors or fittings are left in a position or so placed to cause connection to exposed live terminals.
- (i) The current rating, voltage rating, fusing factor and/or breaking capacity of protective fittings are appropriate to the circuits they protect.

- (j) Switches and protective fittings are identified by a numbering/naming system or labelled as to the type of circuit they control or protect.
- 3.2.3 Inspection requirements for earthing leads, including new earthing leads of a railway signalling installation, shall include checks that:
- (a) The earthing lead is of the correct size.
 - (b) The earthing lead is correctly connected to the protection fitting.
 - (c) The earthing lead is connected to the earth electrode by a suitable corrosion-resistant connection.
 - (d) The earthing lead terminations are readily accessible.
- 3.2.4 All earthing lead connections shall:
- (a) Be mechanically sound; and
 - (b) Be protected against mechanical damage, corrosion, and any vibration likely to occur; and
 - (c) Not impose any appreciable mechanical strain on the component fittings of the connection; and
 - (d) Not cause any mechanical damage to the conductor or associated fittings.

SECTION 4

TESTING REQUIREMENTS

4.1 GENERAL

- 4.1.1 The testing of work carried out on railway signalling installations shall comply with the requirements of this section. *(see Appendix B for Sample Form)*
- 4.1.2 Prior to and during testing, precautions shall be taken to ensure persons will not be subjected to electric shock from tests.
- 4.1.3 Testing instruments shall:
 - (a) Be checked prior to and after testing to ensure that they are in good working order; and
 - (b) Be used in accordance with their design operating criteria.
- 4.1.4 Fittings forming part of the railway signalling installation which may be damaged by test voltages may be disconnected or bypassed as appropriate before testing is carried out.

4.2 INSULATION RESISTANCE TESTING

- 4.2.1 Insulation resistance tests shall comply with the requirements of clause 4.2.3 and shall ensure that the values of insulation resistance meet the requirements of clause 4.2.4.
- 4.2.2 Testing shall be carried out using a 500 V insulation resistance tester.
- 4.2.3 Insulation resistance tests shall be made between:
 - (a) Each conductor run to the supporting rack metalwork.
 - (b) Each supply busbar or power supply unit *(with all connected circuits attached)* to earth.
 - (c) Each supply busbar or power supply unit *(with all connected circuits attached)* to all other separately isolated low or extra low voltage railway signalling circuit busbars in the same location.
 - (d) Conductors of all cables *(between and to earth)*.
- 4.2.4 Values of insulation resistance recorded during tests shall not be less than:
 - (a) For cables 20 megohms*
 - (b) For the installation 1 megohm *

* *Note that these values may be reduced in defined circumstances as detailed in the rail owners technical documentation.*

4.3 EARTH CONTINUITY TESTS FOR SURGE PROTECTION FITTINGS

Earth continuity tests for protection fittings shall ensure that the connection between any point on the installation required to be earthed (*e.g. surge protection*) as shown on the installation drawings (*or as required by the rail owners technical documentation*) and the earth electrode is continuous and has a resistance not exceeding 0.5 ohms.

4.4 TRANSFORMER TESTS

4.4.1 Transformers (*or battery eliminators*) shall be tested to ensure that there the input and output windings and earth are separated.

4.4.1.1 The insulation resistance between the primary winding to the secondary winding terminals shall be not less than 50 megohms (*or as required by the rail owners technical documentation*).

SECTION 5**CERTIFICATION REQUIREMENTS****5.1 GENERAL**

- 5.1.1 A Certificate (*see Appendix C for Sample Form*) is required for all new railway signalling installations, and additions and alterations to existing railway signalling installations, where LVRSCCV is used, shall be certified. However, certification may be provided for existing railway signalling installations on which no electrical work has been carried out.
- 5.1.2 A Certificate shall be issued in respect of a railway signalling installation, or part of an installation, which has been inspected and tested in accordance with this Code.
- 5.1.3 The Certificate shall be filled out by the person who carried out work on the signalling installation.
- 5.1.3.1 A copy of the Certificate shall be given to the person responsible for retaining such records or by the person who issued the certificate.

APPENDIX A1**EXAMPLE FORM OF AN INSPECTION CERTIFICATE FOR EXISTING LOW
VOLTAGE A.C. RAILWAY SIGNALLING CIRCUITS**

Location(s)/Site _____

ITEM	CLAUSE	CHECK	AP
Conductors/Cables show no undue evidence of Insulation/Sheath Deterioration	3.1(a)		
Earth Electrodes, Connections, and Leads show no undue Deterioration or Damage	3.1(b)		
No undue evidence of Damage/Overheating/Arcing to Lamp Holders	3.1(c)		
No Deterioration of Conductor Insulation in Fittings	3.1(d)		
No Mechanical Damage to Fuses, Terminals and Switches	3.1(d)		
No Insulation Deterioration on Overhead Lines carrying LVRSCCV	3.1(e)		
No Rusting of Anchorages or Deterioration of Line Boxes/Jointing Points on Overhead Lines carrying LVRSCCV	3.1(e)		

Completed by _____ Signature _____

Designation _____ Date _____

APPENDIX A2

**EXAMPLE FORM OF AN INSPECTION CERTIFICATE FOR NEW/ALTERED
LOW VOLTAGE A.C. RAILWAY SIGNALLING CIRCUITS**

Location(s)/Site _____

ITEM	CLAUSE	CHECK	AP
Fittings not Damaged	3.2.2(a)		
Conductors correctly Identified	3.2.2(b)		
Conductors connected to correct Fitting Terminals	3.2.2(b)		
Conductors are Securely held in Terminals of Fittings and not subject to Tension at Terminations	3.2.2(c)		
Fittings match expected Load, Supply Voltage, and Rating of Feed Circuit Protective Fittings	3.2.2(d)		
Adequate Insulation between Live Conductors and Live Conductors to Earth	3.2.2(e)		
Fittings are Adequately Supported	3.2.2(f)		
Fittings Designed for Environment where Located or Suitably Enclosed	3.2.2(g)		
No Loose Conductors or Fittings	3.2.2(h)		
Ratings of Protective Fittings are appropriate to the Circuit they Protect	3.2.2(i)		
Switches/Protective Fittings are correctly Identified or Labelled	3.2.2(j)		
The Earthing Lead is the correct Size	3.2.3(a)		
The Earthing Lead is correctly Connected to the Protective Fitting	3.2.3(b)		
Corrosion Resistant Connection of Earthing Lead to the Earth Electrode	3.2.3(c)		
Earthing Lead Terminations are Readily Accessible	3.2.3(d)		
Earthing Lead Connections are Mechanically Sound and Protected	3.2.4 (a)-(d)		

Completed by _____ Signature _____

Designation _____ Date _____

APPENDIX B**EXAMPLE FORM OF A TEST CERTIFICATE FOR NEW, ALTERED AND/OR EXISTING LOW VOLTAGE A.C. RAILWAY SIGNALLING CIRCUITS**

Location(s)/Site _____

ITEM	CLAUSE	CHECK	AP
Insulation Test - Conductors to Supporting Rack Metalwork	4.2.3(a)		
Insulation Test - Supply Busbar/PSU to Earth	4.2.3(b)		
Insulation Test - Supply Busbar/PSU to all other Supply Busbars in same Location	4.2.3(c)		
Insulation Test - Conductors to all Cables (between & to earth)	4.2.3(d)		
Earth Lead Continuity Test	4.3		
Insulation Test - Signalling Transformers, DC PSU's/Battery Eliminators	4.4.1		

Completed by _____ Signature _____

Designation _____ Date _____

APPENDIX C

**EXAMPLE FORM OF A CERTIFICATION CERTIFICATE FOR LOW VOLTAGE
A.C. RAILWAY SIGNALLING CIRCUITS**

Location(s)/Site _____

Description of work carried out _____

Reason for work carried out _____

INSPECTION CERTIFICATE(S) NEW/ALTERED ATTACHED: YES/NO

INSPECTION CERTIFICATE(S) EXISTING ATTACHED: YES/NO

TESTING CERTIFICATE(S) ATTACHED: YES/NO

I certify that the electrical work described above has been inspected and tested in accordance with the requirements of NZECF:60.

Name _____ Signature _____

Designation _____ Date _____