

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 03		
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Issue No. 02	Issue Date: 06/09/14	Compliance Date: 06/03/15

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This section contains the defined checks and tests used in maintenance testing.

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End

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NR/SMTH/Part 03
Defined Checks and Tests
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 04/06/11

1. General

Maintenance Test Plans and Missing Equipment Test Plans use the checks and tests which are defined in this standard. Defined tests shall only be undertaken by, or under the supervision of, Maintenance Testers.

2. Defined Checks

Checking guidelines are provided in Appendix A covering the following topics:

- Checking replacement equipment is of the correct type,
- Checking replacement equipment is not damaged,
- Checking that wiring insulation is safe,
- Checking replacement equipment is correctly installed,
- Checking equipment is electrically isolated during work,
- Checking for adequate labelling,
- Correlation checking to ensure that the equipment/wiring agrees with the site drawings.

3. Defined Tests

Testing techniques are defined in Appendix B covering the following:

Wire Count

To visually check that the correct number of wires or conductors are connected to each terminating point as shown on the wiring diagrams and any analysis.

Continuity Test

To check that the integrity of continuity and correspondence of individual wires or cable cores.

Insulation Test

To check that a cable, wire, spare core or other equipment meets the required insulation criteria.

Cable Function Test

To check that each circuit in a cable functions correctly after work on that cable.

Earth Tests (DC and AC)

To check that equipment and power supplies (non-earthed) are earth free.

Aspect Test

To check that only the correct signal aspect is displayed.

Point Detection and Correspondence Test

To check that the required correspondence between points and their controls and indications is achieved and check that the detection contacts are effective.

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Block Tests (various)

To check that correct operation of specified block equipment.

TPWS Tests

To check that correct operation.

Mechanical Locking Function Test

To check that that each mechanical lever is locked in its correct position.

End

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NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NR/SMTH/Part 03/Check A01
Defined Check: Check for Correct Type
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

This is the first of seven guidelines suggesting the checking measures considered appropriate as part of Maintenance Testing:

When a replacement item of equipment is selected for installation it shall be operationally equivalent to the item it replaces. This includes having the same voltage and frequency rating and a current or power rating as close to, but not less than, the item being replaced. Fuse ratings may need to be considered. The British Rail, Railway Group Standard, Network Rail or other specification number should be the same as the original item or directly compatible with it. Modification states shall be checked for compatibility where appropriate. The size of the replacement item shall also be considered where different. If any rewiring or repositioning of the equipment is necessary the work shall be treated as a temporary diversion of circuits.

Where applicable the contact arrangement, pin code and coil resistance of the replacement shall be checked against the item being replaced. Plug-in relays shall be checked using a relay test set before being made available for use. The test set should prove that contacts open and close correctly and prove polarity characteristics at working voltage. It should be noted that relay coil resistances can vary between different manufacturers' designs for the same type of relay, particularly for BR930 series relays.

Particular care shall be taken to check that any configurable wiring or straps internal to the replacement item is correct and that the item will be operationally equivalent to the item it replaces.

The labelling of the replacement item shall be checked including any dates. Certain terminals or contacts may be labelled differently to the original item. If this labelling is clear, not misleading and not conflicting with the diagram, an item which, in all other respects is suitable may be considered operationally equivalent. If there is any risk of confusion or the diagram conflicts with the equipment then the work should be treated in the same way as a temporary diversion of circuits.

End

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NR/SMTH/Part 03/Check A02
Defined Check: Check for Damage
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

When a replacement item of equipment is selected for installation it shall be visually examined for physical damage. This includes obvious mechanical damage, dents, scrapes, cracks or misalignments. Mechanical parts shall be checked to ensure that they do not bind.

The equipment shall be checked for signs of excessive contamination by rust, grease, verdigris, or moisture, infestation by insects or rodents, or any signs of metallic contamination.

Relays in particular shall be carefully examined and any found with the following conditions shall not be put into service but either returned for servicing or scrapped:

- Flaking plating on relay internal framework and components.
- Prototype relays or relays of suspect origin.
- Ill fitting or warped / yellowing, damaged / cracked or loose covers.
- Damaged or broken adjustment cards.
- Presence of foreign bodies inside relay.
- Defective or missing labelling.
- Presence of Silver Sulphide contamination.
- Defective or missing seals.
- Severe contamination, water, heat damage, physical damage (other than cosmetic).
- Unused holes in case.
- Misalignment or mechanical damage which may have occurred in transit.
- For BR 930 style relays manufactured by GEC, AEI-GS, AEI-GRS, GRS, or SGE, check that lifting card retainers are fitted.
- Storage exceeding 3 years, see below.

Refer to the relay equipment standard for details of the above conditions.

Relays can be put into service if they have been stored from new or following servicing for up to 3 years.

Relays that have been stored for 3 years or over, but less than 10 years shall be tested for correct operation, preferably in a suitable test set, prior to installation.

Relays that have been stored for 10 years or longer shall not be inserted into service without being serviced or fully tested to specification.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NR/SMTH/Part 03/Check A03
Defined Check: Check for Safe Insulation
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

Before wiring is disconnected from an item of equipment or links it shall be visually examined to check that it is not damaged and that the insulation is safely intact, particularly around crimps. Two main forms of insulation deterioration can occur. The insulation can harden, become brittle and in some cases crumble away. In other cases the inner core can soften to a liquid and ooze out through a split outer core.

Immediately adjacent wiring likely to be disturbed by the work shall also be examined. If the insulation is found to be defective your Section Manager (Signals) shall be advised and suitable action proposed. This may include replacement of defective wiring prior to allowing the work to continue.

End

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NR/SMTH/Part 03/Check A04
Defined Check: Check for Correct Installation
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

When a replacement item of equipment is installed it shall be examined to check that it is correctly positioned in any base, mounting or route. This includes being the correct way up and level where required. The equipment shall be fixed securely as designed using any screws, bolts, pins and clips provided. The base, mounting or route shall also be suitably secure.

Any crimps used shall be undamaged and of the correct type. Care shall be taken to use the correct crimp tool and to check that the crimp is secure on the wire end with no strands of conductor outside the crimp barrel.

Any protection required, such as terminal shrouds, shall be correctly fitted. Care shall be taken to ensure any equipment connections are properly terminated and that no stray electrical connection or mechanical snagging is possible. Wires and cables shall be suitably restrained to minimise disturbance and prevent damage or trapping during routine access to the equipment room, apparatus case or route.

End

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NR/SMTH/Part 03/Check A05
Defined Check: Check for Correct Isolation
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

When an existing item of equipment is required to be electrically isolated from working circuitry there are three acceptable methods. Where the item to be replaced is a cable or wire, both ends shall be isolated. If there is any doubt more than one method of isolation shall be carried out. The three methods of isolation are:

- Disconnection at a plugboard,
- Removal and refitting of a cable core/wire,
- Slipping links / removing fuses.

2. Disconnection at a Plugboard

All necessary checks and tests are contained within the Maintenance Test Plan.

3. Removal and Refitting of a Cable Core / Wire

Where removing and refitting a cable core/wire is part of the process of replacing an item of equipment all necessary checks and tests are contained within the Maintenance Test Plan.

Where the removal and refitting of a cable core/wire for isolation purposes is carried out at a point in the circuit remote from the item of equipment to be replaced Maintenance Test Plan Part 04/CA01 steps 1 to 9 shall be carried out.

The use of Maintenance Test Plan Part 04/CA01 for this purpose shall be recorded.

In either case the Maintenance Tester shall check that any disconnected wires are temporarily insulated (see NR/L3/SIG/10064/E052). The method of temporary insulation used shall be robust and not be compromised by the work to change the item of equipment. Consider, for example:

- Pulling wires through small cable entries.
- The danger of inadvertent operation of equipment during replacement / testing.
- The risk of sparking causing explosion.

4. Slipping Links / Removing Fuses

Procedures for links slipped during the work or testing are described in NR/L3/SIG/10064/B002. Fuses removed for isolation purposes shall be dealt with in the same way as links slipped during the work.

End

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NR/SMTH/Part 03/Check A06
Defined Check: Check for Correct Labelling
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

Labelling is referred to in three contexts within the Maintenance Test Plans:

- The labelling of equipment to determine its function, e.g. relay label on a rack: '34 HR'.
- The labelling of wires and cables for termination onto replacement equipment or links.
- The stamping of locking components for replacement into the correct position in a mechanical locking frame.

2. Correct Labelling of Equipment

Within location cases or buildings, equipment will normally have a number/function label associated with it. Many Maintenance Test Plans shall specify a check to ensure this label is correct.

Where no such label exists arrangements shall be made to fit one at the earliest opportunity in accordance with the appropriate installation standards. A note to this effect shall be recorded.

3. Correct Labelling of Cables and Wires

Many Maintenance Test Plans specify the correct labelling and subsequent independent checking of cables and wires where disconnection is required as part of the like-for-like replacement or for the temporary diversion of circuits.

A wire or cable core is correctly labelled when it is uniquely marked or identified and its label corresponds to the diagram. This can be achieved by checking the wire or cable core is terminated correctly prior to labelling or, where it is not terminated, its identity shall be physically traced or electrically proved. Electrical proving shall require positive proof of connection rather than apparent absence of a connection. Use of the CONTINUITY TEST may be appropriate. If practical, wires shall be removed and refitted one at a time.

Cable core numbers or wire bead markers may be acceptable when clearly visible and unambiguous. In other cases a tie-on or stick-on temporary label may be required. Temporary labels shall not damage either wires or equipment. They shall be removed on completion of the work or on rectification of a temporary diversion to avoid confusion. The essential feature is that everyone likely to be involved in the work or testing shall understand the labelling system adopted.

A process for the temporary labelling of diverted cable cores is given in NR/L3/SIG/10064/E031.

End

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NR/SMTH/Part 03/Check A07
Defined Check: Correlation Check
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

Correlation is the comparison of an existing signalling system with the current design records, to check that the two are in agreement.

There are two types of correlation. Where major and complex projects are to be undertaken, which will eventually be Works Tested, a comprehensive correlation will be required. SMTH testers may undertake this correlation, but will need to work to a defined correlation copy of the wiring diagrams. This type of correlation will be specifically called up in the Method Statement for the work. For work which will be Maintenance Tested, the process will be abbreviated. Competence to correlate is not a special competence, it is given by competence to inspect equipment, wire count and record tests in accordance with NR/SMTH.

The process of correlation goes beyond that of WIRE COUNT, because it requires:

- A set of drawings, stamped 'CORRELATION COPY'.
- Physical tracing or electrical proving of circuitry/ cables to ensure that they run to where the diagrams state.
- Verification of equipment profiles, types and labelling.
- Tick marks to record the scope of each check.

Correlation requires two members of staff, one of whom shall be deemed competent to carry out correlation. The assistant shall check the equipment and the competent correlator shall mark the diagrams.

The equipment shall be checked **TO THE DIAGRAMS** to avoid any chance of differences to the diagram being missed.

Caution:



Take care to avoid disturbing fragile or degraded wiring

2. Before Starting Work

2.1 Full Correlation

- 01 Check that wiring diagrams are stamped 'Correlation Copy', and the correct circuitry is identified for correlation.
- 02 Check that the Correlation Copy and Maintenance Copy are the same issue.
- 03 EARTH TEST (DC) or EARTH TEST (AC) as appropriate.

2.2 SMTH Correlation

- 01 Check that the correct circuit is identified for correlation.

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- 02 Check that a diagram is available to correlate the circuit against. Note that very simple correlation can be made against the maintenance copy of the drawings. Should the work be more complicated, a photocopy of the relevant drawing is acceptable. (Note that where a photocopy is used, the copy should be kept with the NR/SMTH test record on completion of testing).
- 03 If a photocopy is used, Check that the photocopy and the maintenance copy are the same issue.
- 04 Optional test: EARTH TEST (DC) or EARTH TEST (AC) as appropriate. (It is strongly advised that this test is undertaken when working in locations and interlockings)

3. Correlation Checks

Carry out the procedure listed below, appropriate to the equipment that requires correlation, marking the diagrams in accordance with NR/GN/SIG/11723.

Further details are given in NR/GN/SIG/11115.

3.1 Equipment Rooms, Signal Boxes and Location Cases

- 01 Check of relay and equipment racks (where applicable) to include:
 - Profile check front and rear (including spaces),
 - Equipment check (including ratings, mod states and, where applicable, adjustment, e.g. for timers and capacitors),
 - Check for Correct Labelling.
- 02 WIRE COUNT the installation to wiring diagrams.
- 03 WIRE COUNT the installation to contact analysis (where available).

3.2 Point Machines, Signal Heads & Trackside Equipment

- 01 Equipment check to include:
 - Type of equipment,
 - Position of equipment/ type of mounting,
 - Check for Correct Labelling.
- 02 Prove tail cables. Tail cables shall be physically traced. If this is not possible, they shall be electrically proved.
- 03 WIRE COUNT the installation to wiring diagrams.

3.3 Lineside Cables

- 01 Check at both ends of the cable, to include:
 - Correct cable identification,
 - Cores correctly terminated on links/ binding posts.

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02 WIRE COUNT installation to wiring diagrams.

3.4 Track Circuit Bonding

01 Check the whole track circuit, to include:

- Position and type of TC bonds,
- Disconnection boxes (where applicable),
- Check for Correct Labelling (where applicable).

02 Prove tail cables. Tail cables shall be physically traced. If this is not possible, they shall be electrically proved.

03 WIRE COUNT to the bonding diagrams.

04 Check position of insulated rail joints to the bonding diagrams.

05 Check that IRJ clearances conform to any shown on the Bonding Plan and to NR/SMS/Part/Z03.

3.5 Lever Locks, Circuit Controllers & Associated Equipment

01 Equipment check to include:

- Equipment type,
- Lock type and position,
- Lever band configuration,
- Check for Correct Labelling.

02 WIRE COUNT the installation to wiring diagrams.

03 WIRE COUNT the installation to contact analysis (where available).

3.6 Mechanical Locking

This check of component position and connections to the Mechanical Locking Chart is required before and after disarrangement of interlocking for the purpose of replacement or cleaning, when components designed to hold the locking in place are to be removed. It should be appreciated that the application of this check is, itself, likely to cause a disarrangement of interlocking.

01 Check every component to ensure the type, side of cut and shape are in agreement with the Locking Chart, following each connection to other components. The check shall always be performed by inspecting the equipment and checking it **TO THE DIAGRAMS** to check no equipment or connection is missed.

02 If, during the 'Before' section of a Maintenance Test Plan, the correlation reveals an error then **STOP** and advise your Section Manager (Signals).

03 If, during the 'After' section of a Maintenance Test Plan, the correlation reveals an error then the work shall be corrected and independently retested.

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- 04 It is necessary to record the correlation of each component and connection. The diagram shall be marked to show agreement **BEFORE** installation work and in a different style to indicate agreement **AFTER** installation work. It is not be essential to have an unmarked diagram before starting a Correlation Check but there shall be room for additional marks which shall be made in a different colour to previous marks.

Note: The Mechanical Locking Chart may also be known as a Dog Chart, Locking Diagram, or Tappet Diagram.

4. Discrepancies

4.1 Full Correlation

If any discrepancies are found between the wiring diagrams and equipment, the wires shall be traced through and the circuit drawn out in the prescribed manner.

Arrangements shall be made for a competent person to review any discrepancies for any safety implications (e.g. any conceptual design changes).

Any amendments to diagram that are required shall be recorded on correlation log sheets (see NR/GN/SIG/11115) and notified to the Section Manager (Signals) and Signal & Telecom Maintenance Engineer by the reviewer.

4.2 SMTH Correlation

If any discrepancies are found between the wiring diagrams and equipment, the wires shall be traced through. Record any discrepancies. Do not proceed with the post correlation work without authority from your Section Manager (Signals). Full details of the discrepancies shall be sent to your Section Manager (Signals).

5. On Completion

5.1 Full Correlation

- 01 EARTH TEST (DC) or EARTH TEST (AC) as appropriate.
- 02 Check all tick marks have been completed and all discrepancies have been marked up.
- 03 Sign and date each correlation diagram and return them to your Section Manager (Signals).

5.2 SMTH Correlation

- 01 Optional test: EARTH TEST (DC) or EARTH TEST (AC) as appropriate. (It is strongly advised that this test is undertaken when working in locations and interlockings).

End

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NR/SMTH/Part 03/Test B01
Defined Test: Wire Count
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

This is a visual examination to check that the correct number of wires or conductors are connected to each terminating point as shown on the wiring diagrams and any analysis. The wire count shall be carried out with all wires terminated. Care shall be taken to include any vertical links and bus bars. If the conductors are cable cores the cable core numbers shall also be checked for agreement with the diagram. It is not necessary to wire count moulded cables, only the wires on the equipment terminals. Care shall be taken to replace moulded cables correctly.

2. Test

- 01 Check for every terminated wire on the affected equipment that the correct number of wires or conductors are connected to each terminating point as shown on the wiring diagrams and any analysis. A wire count shall always be performed by inspecting the equipment and checking it **TO THE DIAGRAMS** to Check that no wires on the equipment are missed.
- 02 If, during the 'Before' section of a Maintenance Test Plan, the wire count reveals an error then **STOP** and advise your Section Manager (Signals).
- 03 If, during the 'After' section of a Maintenance Test Plan, the wire count reveals an error then the work shall be corrected and independently retested.
- 04 It is **NOT** necessary to record the wire count for auditing purposes, e.g. by ticking the wiring diagrams. The wire count may be recorded if it assists the Maintenance Tester in performing the test. (The wire count grid sheet is suitable for this purpose. An example of a completed grid sheet is shown in on page 2. A suitable blank wire count grid sheet is provided in Part 03/Test B01/Appendix A for copying as required)

Caution:



Whilst making a wire count check that spades/terminals are not loosened, wires are not broken and that there are no loose nuts, washers, off-cuts of wire or other superfluous metal objects in the vicinity of working circuits.

	27HR				27DR			
	R	A	B		R	C	D	
1	1	2	1					
2		1	1					
3	2							
4								
5								
6								
7		1						
8		2						
1						1		
2					2	1		
3							1	
4					2		1	
5								
6								
7							2	
8							1	

**Example of a Filled
In Wire Count Grid
Sheet**

End

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1. Purpose

This test is to check the continuity and correspondence of each individual wire/cable core. Where practicable the test shall be carried out with all wires terminated and all relay connectors locked in their bases, but with all relays, fuses and links removed.

2. Test

- 01 Test for correct polarity/correspondence of a two core cable using a DC source (e.g. battery) connected to one end of the cable and a voltmeter applied to the other.
(TWO CORE CABLES ONLY)
- 02 Test for continuity by connecting a bell/buzzer test set or a multimeter set to ohms/continuity position in turn to both ends of the wire/cable core being tested. Spare cable cores may be used where the ends of the wire/cable core being tested are remote from each other.
- 03 Repeat for the next wire/cable core.

End

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Issue No. 05
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1. Purpose

This test is to make sure that a cable, wire, spare core or other equipment meets the required insulation criteria. Cables carrying signalling circuits will be subject to insulation tests. In certain cases, e.g. telecoms cables, special control measures may apply.

For cable cores, Continuity Test in Part 03/Test B02 shall be carried out first to check that the whole cable is continuous.

2. Cables

2.1 Values

The acceptable safe values of insulation resistance are given in NR/SMS/Part/Z05.

2.2 Values under 1M ohm but above 500k ohms

The Section Manager (Signals) may specially authorise operation at values under 1M ohm but above 500k ohms during corrective maintenance activities. When this authority is used the Signal & Telecom Maintenance Engineer shall be advised at a convenient time.

2.3 Values below 500k ohms

It is permissible for the Route Asset Manager (S&T) to give authority for cables and wires to continue in service with values below 500k ohms while repair/replacement is arranged. However, this requires a satisfactory assessment of the risks of leaving the cable in service, and under **NO** circumstances shall cables or wires with an insulation Value of less than 20k ohms remain in service pending repair/replacement.

3. Test

Cables and wires shall be tested at 250V, 500V or 1000V with a suitable insulation tester depending on the insulation grade [Cable insulation test (NR/SMS/Test/054)].

- 01 Test earth by insulation testing between the earth terminal to be used and a separate test earth.
- 02 CONTINUITY TEST the testing straps to be used. 24 way Insulation Test Straps suitable for connecting conductors together are available.
- 03 Isolate all conductors of the cable from all circuits.
- 04 Test insulation between each core and all other cores in the cable connected together using the testing straps.
- 05 Test insulation between all cores connected together and earth using the testing straps.

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4. Equipment Test

The acceptable safe value of insulation resistance is given in the Maintenance Test Plan. Equipment shall be tested at 250V or 500V with a suitable insulation tester unless otherwise specified in the Maintenance Test Plan.

- 01 Isolate the equipment from external circuitry.
- 02 Test insulation between all terminations (connected together) to which an external cable will be connected and the metalwork of the equipment, e.g. casing.

5. RACI

RACI DETAILS	KEY CONTROL ACTIVITY				
		Section Manager (Signals)	Signal & Telecom Maintenance Engineer	Route Asset Manager (S&T)	
Process Task					
2.1		I	I	I	
2.2	X	AR	R		
2.3			R	AR	
end RACI					

RACI is a means of linking process steps to roles as follows:

- R – Responsible: the individual(s) who perform an activity – responsible for action/implementation – although usually only one, Rs can be shared
- A – Accountable: the individual who is ultimately accountable including yes/no decision and power of veto – only one 'A' can be assigned
- C – Consulted: the individual(s) to be consulted prior to a final decision being made or action taken – two-way communication.
- I – Informed: the individual(s) who need to be informed after a decision is made or action is taken – one-way communication.

End

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Defined Test: Cable Function Test
Issue No. 05
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1. Purpose

This test is to check that each circuit functions correctly after jointing, adding a length of cable or the renewal of a cable or line wire. It also checks for voltages on the circuit capable of falsely energising the circuit function. A particular risk is that the cable being replaced has had one or more crosses between cores at joints (the replacement cable would be substituted omitting the crosses), or the internal wires attached to either end of the cable could have been replaced onto the wrong terminations. Either of these conditions could lead to incorrect functions being operated.

AC equipment with separate local and control coils shall be fed from the same supply. Where this is not the case **STOP** and inform your Section Manager (Signals).
(AC RELAY AREAS ONLY)

'**FIRST** function' is the first item of equipment after the affected length of cable to be directly operated by the circuit under test, e.g. a relay, motor, indicator, etc.

'**FINAL** function' is the indication at the signalling panel or the equipment on site fed by the circuit(s) under test.

Each circuit in the affected cable shall be tested in the following way (refer to Figure 1)

2. Test

- 01 Select and Test **EACH** circuit in the affected cable by following the steps below and referring to Figure 1.
- 02 Insert the links, or connect the internal wires, at each end of the affected length for the circuit to be tested.
- 03 Arrange for the circuit to be energised.
- 04 Check correct operation of all AC phase sensitive equipment where local or control coils are fed from a supply via the cable under test.
(AC RELAY AREAS ONLY)
- 05 Test the circuit at the **FIRST** function for correct polarity.
(DC CIRCUITS ONLY)
- 06 Test the circuit at the **FIRST** function for correct voltage level.
- 07 Test that no stray voltage is present at the **FIRST** function whilst disconnecting the feed to each leg of the circuit at the first fuse, link or terminal unique to the operation of the **FIRST** function, first separately then at the same time. (A Suitable electronic meter with a 150k ohm shunt attached shall be used.)
Reconnect the feed to each leg.
(CABLES CONTAINING ANY SAFETY CRITICAL CIRCUIT)

OR

NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NR/SMTH/Part 03/Test B04
Defined Test: Cable Function Test
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Test that no stray voltage is present at the **FIRST** function when the circuit is de-energised. (A suitable electronic with a 150k ohm shunt attached shall be used)

(CABLES CONTAINING ONLY NON SAFETY CRITICAL OR REMOTE CONTROL CIRCUITS)

- 08 Observe that the **FIRST** function corresponds correctly to the operation of one of its controlling contacts/devices (refer to Figure 1).
- 09 Where the **FINAL** function is different to the **FIRST** function, Observe that the **FINAL** function corresponds correctly to the operation of one of the controlling contacts/devices (refer to Figure 1).
(CASCADED RELAY CIRCUITS ONLY)
- 10 Repeat all above tests for each remaining circuit.
- 11 Test that no voltage can be measured between the supplies fed from different ends of the cable.
(MICROCORE CABLES ONLY WITH SEPARATE COMMON RETURN CONDUCTORS)
- 12 Check that all unused links are removed.

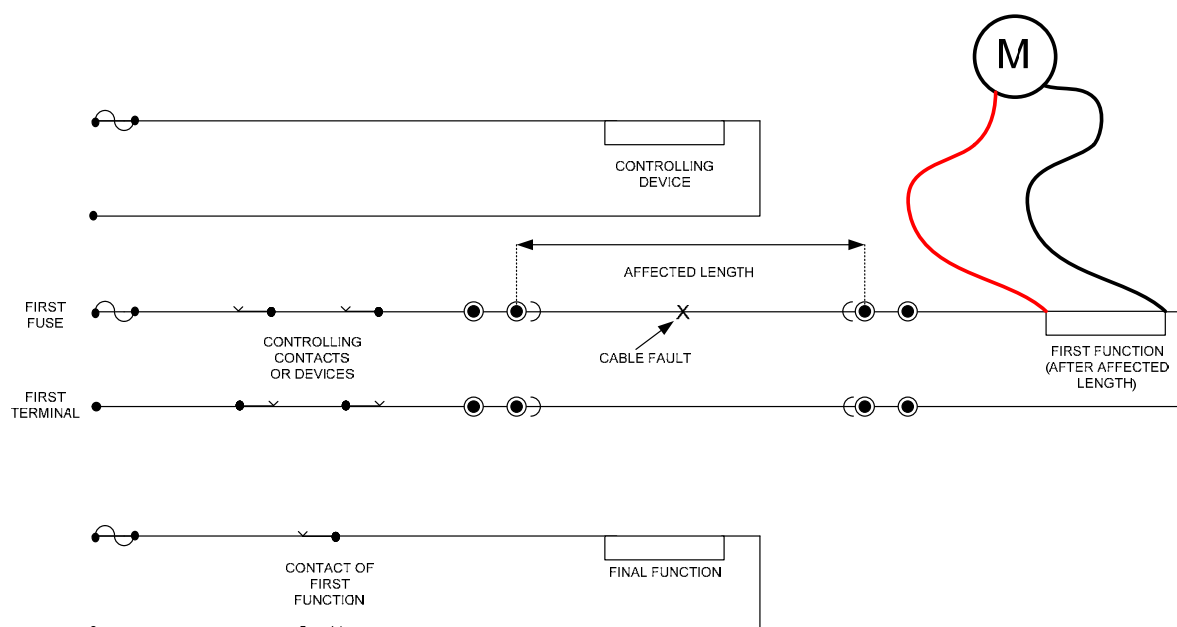


Figure 1: Cable Function Test Schematic

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NR/SMTH/Part 03/Test B05
Defined Test: Earth Test (DC up to a nominal 120V)
Issue No. 05
Issue Date: 01/12/10
Compliance Date: 03/09/11

1. Purpose

This test is to check that equipment and power supplies (when designed to be) are earth free. It makes sure that circuits cannot be falsely operated from spurious feeds. Any earth present may originate from bus bars or from equipment. Where an earth fault detector monitors the equipment the test is not required, but the detector shall be checked for correct operation before and after any work.

For point machines, this test shall be undertaken whilst each machine is operating normal and reverse. For level crossings, this test shall be undertaken throughout the operation cycle.

An appropriately calibrated electronic meter with input impedance of at least 1M ohm fitted with a 150k ohm shunt shall be used.

All test measurements shall be recorded on DC Busbar & Earth Test record card (NR/SMS/T051/RC/02), together with the reason for the test.

2. Test

- 01 Measure the DC voltage between the positive and negative busbars supplying the equipment to be tested. Record the voltage indicated (V).
- 02 With one meter lead connected to earth and the other to the positive busbar, Record the DC voltage indicated (V1). The polarity of the indication can be ignored.
- 03 With one meter lead connected to earth and the other to the negative busbar, Record the DC voltage indicated (V2). The polarity of the indication can be ignored.
- 04 Disconnect the meter and refer to the reportable, acceptable and safety values listed in NR/SMS/Part/Z07 applicable to the actual busbar voltage (V). If the required busbar voltage is not listed select the nearest busbar voltage shown that is less than the measured voltage.

3. Results

3.1 Less than the Reportable Range

The recorded values of V1, V2 and V1+V2 are less than the reportable range no further action is required.

3.2 In the Reportable or Maximum Acceptable Range

If the recorded values of V1, V2 and V1+V2 are in the reportable or maximum acceptable range, the Section Manager (Signals) shall be advised preferably immediately and certainly within 24 hours. The Section Manager (signals) shall decide if any further action is required.

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3.3 More than the Maximum Acceptable Value

If any of the recorded values of V1, V2 and V1+V2 are more than the maximum acceptable voltage values then the Section Manager (Signals) shall be advised preferably immediately and immediately within 24 hours. The Section Manager (signals) shall decide if any further action is required.

3.4 More than the Maximum Safety Value

If any of the recorded values of V1, V2 and V1+V2 are more than the maximum safety voltage values immediate action shall be taken. If the fault cannot be cleared the Section Manager (Signals) shall be advised immediately and decide the action to be taken.

4. Rectification of Earth Faults

All earth fault conditions are potentially serious and may be located by methodical disconnections. When an earth fault outside acceptable limits is found, Rectify the fault as corrective maintenance. Report to your Section Manager (Signals) the problem and any difficulties rectifying it. Failure to rectify shall be reported to your Section Manager (Signals) for necessary remedial action – the report shall be made preferably immediately and certainly within 24 hours. Check that any earth faults in the “Reportable Region”, or any worsening trends in earth readings, are rectified or reported in accordance with NR/SMS/EL21 and NR/SMS/EL31.

5. RACI

RACI DETAILS	KEY CONTROL ACTIVITY			
		Maintenance Tester	Section Manager (Signals)	
Process Task				
3.1		I	I	
3.2		R	AR	
3.3		R	AR	
3.4		R	AR	
end RACI				

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RACI is a means of linking process steps to roles as follows:

- R – Responsible: the individual(s) who perform an activity – responsible for action/implementation – although usually only one, Rs can be shared
- A – Accountable: the individual who is ultimately accountable including yes/no decision and power of veto – only one 'A' can be assigned
- C – Consulted: the individual(s) to be consulted prior to a final decision being made or action taken – two-way communication.

I – Informed: the individual(s) who need to be informed after a decision is made or action is taken – one-way communication.

End

NR/L3/SIG/11231 Signal Maintenance Testing Handbook
NR/SMTH/Part 03/Test B06
Defined Test: Earth Test (AC up to a nominal 110V)
Issue No. 05
Issue Date: 05/03/11
Compliance Date: 03/09/11

1. Purpose

This test is to check that equipment and power supplies (when designed to be) are earth free. It makes sure that circuits cannot be falsely operated from spurious feeds. Any earth present may originate from bus bars or from equipment. Where an earth fault detector monitors the equipment these tests are not required, but the detector shall be checked for correct operation before and after any work.

For point machines, this test shall be undertaken whilst each machine is operating normal and reverse.

An appropriately calibrated electronic meter with input impedance of at least 1M ohm shall be used.

Caution:



The 150k ohm shunt shall NOT BE USED with the meter when carrying out AC earth tests using the AC busbar earth test adaptor.

All test measurements shall be recorded on AC Busbar & Earth Test record card (NR/SMS/T051/RC/01), together with the reason for the test.

2. Test

- 01 Connect the meter set to volts DC to the red and one of the black terminals of the AC busbar earth test adaptor (see Figure 1).
- 02 Connect the green and other black terminal of the AC busbar earth test adaptor together and Measure the battery voltage (VB). Check VB is no less than positive 8V, which shows that the earth test adaptor is working and that the meter is connected the right way round. If VB is less than 8V, the battery shall be changed.
- 03 Remove the connection between the green and black terminals. Connect the green terminal of the adaptor to earth and the black terminal to either the BX or NX busbar. Record the DC voltage indicated (V1).
- 04 Reverse the leads to the selected busbar and earth so that the black terminal of the adaptor is connected to earth and the busbar is connected to the green terminal of the adaptor. Record the DC voltage indicated (V2).
- 05 Disconnect the test circuit and refer to the reportable, acceptable and safety values listed in NR/SMS/Part/Z07 applicable to the actual adaptor battery voltage VB. If the required adaptor battery voltage is not listed select the nearest battery voltage shown that is less than the measured voltage.

3. Results

Calculate $V1+V2$ and $V1-V2$ (*)