

NR/L3/SIG/11231 Signal Maintenance Testing Handbook		
NR/SMTH/Part 02		
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Issue No. 03	Issue Date: 04/03/2016	Compliance Date: 04/06/2016



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1 Purpose

The purpose of the document is to define maintenance testing requirements and processes to allow equipment to be returned to service safely.

2 Scope

Maintenance Testing covers both reactive corrective work (e.g. the rectifying of faults and the replacement of faulty items on a like for like basis) and minor renewals (e.g. pre-planned work to renew existing signalling equipment that are like for like) that are not Extensive and Simultaneous.

3 Format of SMTH

Parts 01 to 02:

Detail the references and processes applicable to all Maintenance Testing

Part 3:

Covers defined checks and tests that are undertaken as part of Maintenance Testing.

Part 4:

Deals with the like for like replacement of signalling assets or missing assets that arise through corrective maintenance activities usually as a result of a failure.

Part M04

Deals with the like for like replacement of missing signalling assets that arise through corrective maintenance activities.

Part 5:

Deals with failure investigation of signalling assets.

Part 6:

Deals with like for like replacement of telecom assets or missing assets that arise through corrective maintenance activities usually as a result of a failure.

Part 7:

Deals with Maintenance Testing of signalling assets that are like for like but are part of pre-planned activities

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3 Principles of SMTH

Maintenance Testing is based on the principle that the equipment was fully tested at commissioning and has been working correctly. The design may therefore be taken to be correct and the work will not require a change to diagrams unless permitted in the maintenance test plan required as a result of correlation.

Working on equipment that is in service, with further information on disconnection, insulation, releasing, isolation, reset, restoration, diversion and monitoring is covered in NR/L3/SIG/10064 (General Instructions to Staff Working on S&T Equipment).

The principles for the diversion of circuits for various reasons (e.g. from faulty to spare cores, the reallocation of a faulty relay contact and the emergency repositioning of an item of equipment) are given in NR/L3/SIG/10064/E031. Signalling circuits in cables shared with telecommunications functions should be identified and tested in accordance with NR/L3/SIG/10064/E041.

4 Objectives of Maintenance Testing

The objective of Maintenance Testing is to prove that the signalling equipment is safely returned to service. The vital test requirements necessary to prove safe working of equipment are listed to validate that none are overlooked.

Equipment covered by Maintenance Testing shall be tested in accordance with the maintenance test plans or missing equipment test plans contained in this document, unless an equivalent or better alternative is approved by the Signal & Telecom Maintenance Engineer. This approval process shall include a risk assessment and be required to demonstrate that the proposed alternative does not reduce the safety risk. The requirements for a maintenance test plan and missing equipment test plan are given in NR/SMTH/Part 02/Appendix B.

Wrong Side Failures, accidents and other serious incidents shall be investigated using the guidelines contained in NR/SMTH/Part 05 of this document (Failure and Incident Testing), unless an equivalent or better alternative is approved by the Signal & Telecom Maintenance Engineer. This approval process shall include a risk assessment and shall be required to demonstrate that the proposed alternative does not reduce the safety risk.

Part 05 of SMTH is not exhaustive, but is intended to prove that reported failures are thoroughly investigated, that information is adequately recorded and that vital evidence is not destroyed by the testing.

A selection of fault finding guides can also be found in Part 05

5 Testing Management

Maintenance Testing allows for safe testing to suit the varied circumstances of like for like equipment replacement as part of preventative and corrective maintenance where pre-planning cannot be undertaken.

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For like for like minor renewals, pre-planning of the work shall be carried out. The process in Section 7 is to be followed.

5.1 Work which is “Extensive and Simultaneous”

If any of the following criteria are exceeded then the work **shall** be classed as extensive and simultaneous and **shall not** be undertaken as maintenance testing :

- a) If the number of staff required on any one shift exceeds three teams of three people.
- b) If the disconnection work will exceed one shift. Maximum of 12 hours.
- c) If the reconnection work will exceed one shift. Maximum of 12 hours.
- d) If there are more than thirty tail cable disconnections. In areas fitted with Plug and Play this number can be increased to fifty.
- e) A maximum of two point machines per team. In areas fitted with Plug and Play this number can be increased to four per team.
- f) A maximum of two signal head replacements (all types) per team. In areas fitted with Plug and Play this number can be increased to six per team.
- g) Excluding rapid response incident, the planned replacement of a lineside multi-core cable affecting signalling equipment on more than two lines that are in service.

The Engineer in charge of the work (typically the S&TME or Project Engineer) may apply to the Route Asset Manager (Signalling) (RAM(S)) for permission to work outside of this criteria.

The (RAM(S)) may give permission to allow work outside of this criteria.

The dispensation shall be given in writing. Before giving permission, the RAM(S) shall be assured that the associated risks are adequately controlled.

The evaluation of risk shall take into account the following, as a minimum:

- a) The exact nature and scope of the work – details
- b) Local circumstances
- c) Criticality of the affected equipment
- d) Density of service
- e) Other operational issues that are ongoing, but not related to the SMTH issue.
- f) Consequences of the SMTH work not going to plan.
- g) Possible operational “work arounds”.
- h) Quality and competency of staff who will undertake the work.
- i) Quality and competency of staff who will supervise the work.

The RAM(S) is accountable for the final decision to authorise any request for permission to work outside the criteria.

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5.2 Maintenance Tester

Maintenance Testing shall only be carried out by competent staff.

The lead Maintenance Tester shall be in overall charge of the testing. The lead Maintenance Tester shall determine the extent of the work, confirm that the work can be undertaken using the SMTH and decide which maintenance test plans are appropriate.

5.3 Testing Work

Appropriate maintenance test plan(s) for the work in Part 04, M04, or 06 (corrective maintenance activities) shall be selected and carried out in sequence:

- a) 'Before Installation' tests, checks or preliminary work,
- b) The replacement or diversion work itself,
- c) 'After Installation' tests or checks.

Any errors found in the work during testing shall be corrected by the person doing the work. This shall be rechecked by the maintenance tester along with anything that could have been affected by the remedial work.

If the available diagrams have previously been amended by hand, e.g. with a temporary diversion, details shall be noted as part of the record of test. Maintenance test plan steps which are required but cannot be carried out, shall be recorded on the SMTH Log Book slip as part of the record of the test. The SM (S) permission shall be obtained before equipment is returned to service.

If the work undertaken is pre-planned, the required maintenance test plan shall be identified as part of the planning process (see Section 9).

If a maintenance test plan is considered deficient in anyway, details shall be noted as part of the record of test and any additional tests carried out before the equipment is returned to service. The query shall be reported to the SM (S) as soon as possible. The SM (S) shall arrange to have the equipment retested if a maintenance test plan is considered deficient. The Signal & Telecom Maintenance Engineer shall be responsible for escalating the deficiency to Route Asset Manager (Signals).

5.4 Testing Where No Maintenance Test Plan Exists

Where no suitable maintenance test plan exists for the work to be undertaken in Part 04 or M04, and unless an exemption is stated, a new maintenance test plan shall be produced by the Maintenance Tester. The requirements for a maintenance test plan and Missing Equipment Test Plan are given in NR/SMTH/Part 02/Appendix B.

Before use, the new maintenance test plan shall be checked by a Maintenance Tester not involved in writing it. This check shall be undertaken on site with reference to the equipment concerned except where the person concerned is sufficiently

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familiar with the equipment, in which case the new maintenance test plan may be agreed by telephone or checked off site.

If there is not a suitable maintenance test plan for items in NR/SMTH/Part/07, one shall be produced as part of the pre-planning process. The test plan shall be produced by a suitably competence Maintenance Tester and checked by an independent suitably competence Maintenance Tester. The process detailed in NR/L2/SIG/30014/A210 (Design and Testing Process for Minor or Repetitive Alterations) shall be undertaken for this work.

If there is any doubt about the testing required, and whether it is maintenance testing, the Signal & Telecom Maintenance Engineer shall be consulted.

On completion of the work and testing, the new maintenance test plan shall be forwarded as part of the record of test. The Signal & Telecom Maintenance Engineer shall arrange to have the equipment retested if the maintenance test plan is considered deficient. The Signal & Telecom Maintenance Engineer is responsible for forwarding the new maintenance test plan to signalengineers@networkrail.co.uk

5.5 Handover Where Testing Cannot Be Completed

If work is partially tested when the work is directly or indirectly handed over to someone else to complete, the record of test shall be completed for the testing that has been done. A copy shall be forwarded to the person continuing the testing.

The person completing the testing shall establish their own record of test, noting down the tests done by the first team Maintenance Tester to achieve a clear understanding of the state of work at handover. Tests documented as satisfactorily completed need not be repeated but any which are not listed as complete shall be assumed not done. Both records of test shall be submitted to the SM (S) after completion.

5.6 Testing for Correct Operation

On completion of the required testing defined in the maintenance test plan(s) the part of the signalling system affected by the work shall be checked to prove correct operation.

This check may, for example, involve watching a train pass through a signalled route and observing that the track circuits occupy and clear in the correct sequence; signals are restored to danger, etc. It may involve observing that points move in correspondence with the signaller's controls.

If equipment cannot be safely restored to service, then the provisions of Handbook 19 of the Rule Book for failed equipment shall be applied.

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5.7 Testing After Replacement of Missing Equipment

Missing equipment shall be replaced using the Missing Equipment Test Plans. To qualify for replacement, the missing equipment shall have been present and working prior to its damage or removal. Complete and accurate diagrams shall be available and the work shall not require any change to diagrams. A like for like equivalent replacement item shall be used.

Take care to check that critically positioned equipment is replaced in the correct position and orientation, on the correct line and as indicated on the relevant diagrams.

When dealing with missing equipment, any other equipment nearby shall be checked for damage or disturbance.

5.8 On Completion of Testing

Before the equipment is returned to service, the work and all testing shall be completed and a record of test produced, unless exempted in the maintenance test plan. Any test instrumentation or straps provided for testing shall be completely disconnected from the commissioned system, except where permitted by NR/L3/SIG/10064/U033 and NR/L3/SIG/10064/U034.

On completion of the maintenance testing work the Maintenance Tester shall check that the installation / equipment is left in a secure condition and that adequate arrangements have been made for the prompt removal from site of any displaced equipment. Where manual handling is practicable, this removal shall be immediate.

Finally, the signaller shall be requested to restore any signalling functions operated for testing, e.g. cancel routes and normalise levers. Where applicable, the system shall be restored to its normal state in accordance with NR/L3/SIG/10064/B003, i.e. with no stored conditions, before it is permitted to re-enter service.

6 Staff

6.1 Competence

The Signal & Telecom Maintenance Engineer shall be responsible for all staff under their control undertaking Maintenance Testing activities having valid competencies and authorities to work before undertaking this type of work.

6.2 Independence

Maintenance Testing can be used to achieve independent verification of installation work. The Maintenance Tester shall be independent of the installer, except in the case of some straightforward replacements where the maintenance test plan is endorsed 'Independence Exempt'.

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The Maintenance Tester is responsible for checking that the equipment is restored to use in a safe condition. The Maintenance Tester shall not carry out or direct (but may assist) the work which will subsequently be verified by themselves.

The disconnections described in NR/L3/SIG/10064/B002 shall be planned and designed by a maintenance tester and shall be checked by an independent Maintenance Tester.

7 Site & Test Records

7.1 Testing General

Maintenance Testing is based on the assumption that equipment is correctly wired and correctly documented before work commences. Complete and accurate site records shall be available at each installation. A record of test shall be provided by the Maintenance Tester for each replacement or alteration unless exempted in the maintenance test plan. The requirements for test records are given in NR/SMTH/Part 02/Appendix C.

Site and test records for pre-planned work are detailed in Section 7.

7.2 Testing with Site Records

The installation shall be checked by the Maintenance Tester against the diagrams before work is started and again after work is complete to check that the installation is correct. The extent of this correlation activity shall be defined in the maintenance test plan or missing equipment test plan.

7.3 Testing where Site Records have been Amended

If, when needed for fault rectification or renewal work, diagrams are available but have an unsigned and undated amendment which affects that work, the work shall STOP. Advice shall be sought from the SM (S). This also applies to any diagrams found marked 'Installation Copy'.

The following action shall be taken:

- a) If the diagram shows amendments it shall be checked to the wiring on site. If the diagrams are clear and in agreement with the wiring, the SM (S) may allow work to continue. Arrangements shall be made to obtain revised diagrams. If revised diagrams cannot be supplied, the S&TME shall be advised and suitable arrangements made to reduce any risks to as low as reasonably practicable. In both cases a note shall be included with the record of test.

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- b) If the diagrams are unclear, or if a discrepancy with the wiring is found, the SM (S) shall arrange for the discrepancy to be resolved and determine an appropriate method for the work to be completed. Design assistance to produce any revised diagrams should be arranged.

Diagram amendments reported that are unrelated to the work, shall be dealt with using the local procedures for arranging revised diagrams.

7.4 Testing where Site Records Differ from Wiring

If a difference is discovered between the wiring being worked on and the diagram, the work shall **STOP**. Advice shall be sought from the SM (S).

The action to be taken shall depend on the extent of the difference. In all cases, where the diagrams are related to the work in hand a note shall be included with the record of test and arrangements made to obtain revised diagrams:

- a) If the difference only involves the looping arrangement or contact / terminal allocation detail and is otherwise electrically identical, the SM (S) may permit the work to proceed. The diagram shall be suitably amended, signed and dated in red.
- b) If any other discrepancy is found, the SM (S) shall arrange for the discrepancy to be resolved and determine an appropriate method for the work to be completed. Design assistance to produce any revised diagrams should be arranged.

Diagram discrepancies reported that are unrelated to the work, shall be dealt with using the local procedures for arranging revised diagrams.

7.5 Testing where there are No Site Records

If site records are missing, the work shall **STOP**. Advice shall be sought from the SM (S).

The action to be taken shall depend on the work being done. Where work is permitted to continue, as outlined below, the appropriate maintenance test plan(s) shall be used. In all cases, a note shall be included with the record of test and arrangements made to obtain revised diagrams:

- a) If the equipment being changed is a pin-coded plug-in component, the SM (S) may allow the work to proceed omitting any requirement to check to the wiring diagram.

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- b) If the component is a simple piece of equipment not involving control circuitry, the equipment may be changed on the authority of the SM (S) who assess the experience of the staff doing the work and testing. A sketch drawing shall be produced showing the wiring connected to the equipment which shall then be used in lieu of the original diagram. The sketch shall be left on site, signed and dated in red. Transformers and lamp holders are typical of the equipment that can be dealt with in this way.
- c) If the equipment involves control circuitry, additional testing resource shall be involved in the change. Design assistance to produce any revised diagrams shall be arranged. The work shall be tested using NR/L2/SIG/30014 (NR/SWTH).

7.6 Test Records

The Maintenance Tester shall complete a record of the testing carried out and forward it to the SM (S) at the first opportunity after the end of the shift. The record of test, including original Test Plans and SMTH logbook sheets, shall be checked and retained by the SM (S) for the lifetime of the equipment.

A system shall be in place to check returns from each team as well as a more thorough check at least once every three months. This check shall determine that the appropriate maintenance test plans have been used and that sufficient detail has been recorded. Deficiencies shall be followed up by appropriate corrective action such as monitoring or retraining.

7.7 Version Control of Site Records

If there is reason to doubt that the site records are the latest version, ask your SM (S) to confirm the status with the National Records Group.

8. Pre-Planned Work and Non Corrective Maintenance Testing

8.1. Introduction

This section details the requirements for Maintenance Testing that are like for like replacements but are not part of reactive corrective maintenance activities and should therefore be pre-planned.

8.2 Pre-Planned Like for Like Replacements

These activities can include items that are like for like replacements (e.g. relay re-servicing, Silec treadle replacements, installing and change over of a top nutted cable etc) but are not corrective maintenance activities (undertaken as part of reactive failure rectification).

Maintenance Testing of large items including the like for like replacement of a point machine, or the like for like replacement of a signal head shall also be undertaken as part of this section.