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Level 2

Signalling Works Testing

Endorsement and Authorisation

For endorsement, authorisation and issue record of this document, please refer to NR/L2/SIG/30014

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Issue record

Issue	Date	Comments
1	Dec 09	Initial Issue, supercedes NR/SP/SIG/11221
02	Sep 10	A110 – Enquiry recommendation added to section 4.6
03	Jun 12	Incorporation of high level requirements from GK/RT0209, updates and clarifications following industry feedback, including correction of mismatches with other chapters / sections of the handbook.
04	Dec 13	Updates to sections 2, 4.4.3, 4.5.4, 4.5.5.4, 4.5.5.6, 4.5.5.8, 4.5.7, 4.7.1, 4.6.5, 4.8.1, 4.9.2.

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 7 March 2015.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

Reference documentation

Group Standards

GE/RT8000	Rule Book

Company Standards

NR/L3/INI/CP0044	Work Package Planning
NR/L2/INI/CP0075	Procedure for the Entry into Operational Service of Railway Infrastructure
NR/L3/INI/CP0077	Signalling Pre Commissioning Verification Requirements
NR/L2/SIG/10064	General Instructions to Staff Working on S&T Equipment
NR/L2/SIG/11201	Signalling Design Handbook
NR/L3/SIG/11303	Signalling Installation
NR/L2/SIG/30014	Signalling Works Testing Handbook
NR/L2/SIG/30014/A100	Selection of Standards for Signalling Testing
NR/L2/SIG/30014/A210	Design and Testing Processes for Minor or Repetitive Alterations
NR/L2/SIG/30014/A310	Testing Processes for Modular S&C Scheme
NR/L2/SIG/30014/B410	Signalling Works Testing Staff Competence Assessment
NR/L2/SIG/30014/B510	Project Specific Appointment of Signalling Testers in Charge

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NR/L2/SIG/30014/B510/AP02	Appointment of Tester in Charge form
NR/L2/SIG/30014/C110	Testing Strategy
NR/L2/SIG/30014/C110/ST01	Testing Strategy form
NR/L2/SIG/30014/C120	Test Plans
NR/L2/SIG/30014/C120/TP01	Test Plan form
NR/L2/SIG/30014/C120/TP03	Commissioning Plan Addendum / Task Sheet form
NR/L2/SIG/30014/C120/TP11	Test Plan Appendix 1 - Tester in Charge's Briefing Record, Testers' Identity and Mentorship Register form
NR/L2/SIG/30014/C120/TP13	Test Plan Appendix 3, Testing and Commissioning Occurrence Log form
NR/L2/SIG/30014/C210	Acceptance of Testing Planning Documentation
NR/L2/SIG/30014/C210/AC01	Testing Planning Documentation Review Record form
NR/L2/SIG/30014/C310	Check Marking and Recording on Test Copies
NR/L2/SIG/30014/C410	Error Reporting
NR/L2/SIG/30014/C510	Handover for Signalling Works Testing
NR/L2/SIG/30014/D110	Signalling Works Test Specification and Certificate Requirements
NR/L2/SIG/30014/D115	Signalling Works Defined Checks and Tests
NR/L2/SIG/30014/D120	Signalling Works Test Specifications
NR/L2/SIG/30014/E110	Signalling Works Testing Glossary
NR/L2/SIG/30014/F000	Signalling Works Principles Testing
NR/L2/SIG/30097	Modular Signalling

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1 Purpose

This document is part of the suite of documents contained within the Signalling Works Testing Handbook, NR/L2/SIG/30014, which together detail the requirements for signalling works testing activities.

This Level 2 document sets out the mandatory procedures and process controls necessary to confirm that new signalling installations, and alterations to existing installations, are independently tested in a manner that assures:

- Compliance with the Project specifications and Design Details; and,
- Fitness for purpose before they are offered for Entry into Operational Service.

It also provides a framework of procedures and process controls that are, as far as practicable, consistent across the Network Rail infrastructure.

2 Scope

This level 2 standard applies to work that meets the selection criteria defined in NR/L2/SIG/30014/A100.

Moving block testing requirements, such as those required for ETCS / ERTMS, are excluded from the scope of the document.

Modular Signalling testing requirements are detailed in NR/L2/SIG/30097, and that standard shall take precedence over this standard with respect to Modular Signalling Projects. However, where NR/L2/SIG/30097 is silent on any aspect of signalling works testing, this standard shall apply instead.

Modular S&C Scheme testing requirements are detailed in NR/L2/SIG/30014/A310, and that standard shall take precedence over this standard with respect to Modular S&C Schemes. However, where NR/L2/SIG/30014/A310 is silent on any aspect of signalling works testing, this standard shall apply instead.

Manufacturer's product testing is the quality assurance testing in the factory of discrete off the shelf products or equipment. This testing would be carried out to standard drawings in accordance with manufacturer's Quality System, and is certified by the issue of Quality Assurance Certificates or Certificates of Conformance. Manufacturer's product testing is outside the scope of signalling works testing, and is considered to be part of the supply chain quality management system.

Off Site Testing comprises any testing of bespoke, uniquely wired equipment, bespoke systems, data or software that is carried out before such equipment, systems, data or software is installed on site in its final configuration. Off site testing is within the scope of signalling works testing, and shall be carried out in accordance with the requirements of this standard.

Persons using this document for works involving novel systems are directed to seek counsel from the appropriate Safety Cases where specific and particular test requirements shall have been identified.

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It is permissible for simplified design and testing processes to be followed for specific Projects as detailed in NR/L2/SIG/30014/A210, subject to that project meeting the selection criteria in NR/L2/SIG/30014/A100. Where there is a conflict between the processes and requirements shown in this standard and NR/L2/SIG/30014/A210, the requirement shown in that standard shall take precedence over this standard. However, where NR/L2/SIG/30014/A210 contains no requirements on a specific subject, then the requirement of this standard shall be followed.

3 Flowchart

See Appendix A.

4 Procedure

4.1 High Level Principles

4.1.1 Objective of Testing

The objective of testing systems which control or command the safe routing and spacing of trains is to confirm that such systems:

a) Conform to the design requirements for the Project and are as specified in the Technical Workscope, or equivalent document;

b) Conform to statutory requirements, and Railway Group and Network Rail Company Standards;

c) Have been constructed in accordance with the supplied Design Details;

d) Have been constructed in accordance with the relevant installation specifications and codes of practice where these impact on signalling system safety or reliability;

e) Operate within their design and application parameters so far as these relate to the testing of the system;

f) When being altered, are only altered in the expected manner.

The assurance of the quality and completeness of the construction work is a separate activity for which testing staff are not responsible, but the Tester in Charge shall have evidence of it being undertaken; see §4.2.6.

4.1.2 Extent and Rigour of the Testing Process

The extent and rigour of the testing process shall be sufficient to control both the risk of technical deficiencies within the system under test and of systematic failure within the testing process itself. A means of defence against systematic failure within the testing process is the use of over-lapping test activities (for example in signalling systems, to a certain degree the wire count and continuity test overlaps the purpose of the strap and function test).

The testing process shall confirm that the overall system is fit for purpose before Entry into Operational Service.

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4.2 Testing Management

4.2.1 Tester in Charge

For each Project, one individual shall be appointed as the Tester in Charge; this individual shall be named in the Test Plan, along with details of the required competence level for the project, and the Principal Signalling Testing Contractor.

The Tester in Charge is responsible for the organisation, control and satisfactory completion of the testing and shall be appointed in accordance with NR/L2/SIG/30014/B510.

Some Projects require more than one Tester in Charge (where there are stage works or multi-shift working, for example), but only the Tester in Charge as defined in NR/L2/SIG/30014/B510 §4.4.2 has the primary testing management role, and responsibility for the safe and successful completion of the signalling works testing activities. NR/L2/SIG/30014/B510 contains a summary of the different testing management roles, and responsibilities within each role, and typical organisation charts for Projects with multiple Testers in Charge, that could be required on a Project. Additional Testers in Charge shall therefore be appointed in accordance with NR/L2/SIG/30014/B510.

The Tester in Charge is responsible for the production and implementation of the Test Plan(s). Implementation of the Test Plan shall not be delegated. The Tester in Charge can delegate the production or checking of the Test Plan(s), but remains accountable for their completion. However, the Tester in Charge shall either be the preparer or the checker. Test Plans include the Master Test Plan, Preparatory Test Plans, Test and Commissioning Plans, and Commissioning Plans; see section 4.4 for more details.

The Tester in Charge undertakes the management of the testing works and appoints and deploys staff to the testing work. The Tester in Charge shall check that all Testers involved in the work are briefed and fully conversant with their duties. Testers shall be provided with a written statement summarising their duties, authority level and responsibilities on a Project-by-Project basis; this shall usually be by means of issue of the Test Plan and its appendices.

4.2.2 Testing Planning

The testing planning shall be such that the entire testing and commissioning process for the project is documented in a robust, clear and timely manner.

Further details of the requirements for testing planning documentation are given in §**Error! Reference source not found.**.

The testing and commissioning planning shall be integrated with the overall project planning and shall be controlled within the project's quality and safety management systems. The project documentation shall include identification of all testing management interfaces that have a safety function, and shall specify the controls required to verify that risk is not imported at those interfaces. Interfaces include both those which are internal to the management of the testing, and external interfaces with other project activities. The planning of the testing activities shall take due account of all relevant factors.

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The planning of testing and commissioning shall proceed hand-in-hand with any product testing that is required for product acceptance purposes, to provide a systematic approach to the commissioning of the systems.

4.2.3 Hazard Identification, Risk Assessment and Mitigation

The particular hazards associated with the testing and commissioning of signalling systems shall be identified, assessed and eliminated or mitigated before work commences.

The identification, assessment and mitigation of risks shall also include consideration of situations that could lead to ineffective or insufficient testing.

The identified risks and their proposed control measures shall be documented. Where it is necessary for testing personnel to undertake additional or restricted testing as a result of the risk assessment, the testing documentation shall specify the arrangements.

The assessment shall be sufficiently rigorous to verify that all credible risks to the safe operation of the systems are eliminated or mitigated so far as is reasonably practicable.

4.2.4 Compliance with Standards

Testers in Charge shall carry out checks to satisfy themselves that the testing is being carried out in accordance with the appropriate technical standards, and with the Test Plan(s) and Test Specifications.

This requirement is met by:

a) Competence assessment of testing staff in accordance with NR/L2/SIG/30014/B410, prior to allocation to a specific testing activity;

b) Detailed check of completed testing certification;

c) Sample review of Check Marks and test result values on records of testing.

d) Surveillance of testing staff. The frequency of staff surveillance shall be in accordance with the Contractors Quality System.

These tasks can be delegated to other competent staff, but the Tester in Charge is responsible for checking they are satisfactorily completed.

4.2.5 Co-ordination with Railway Operations

Before any period of work during which it is intended to carry out testing on equipment which forms part of, or interfaces with, a signalling system which is operational, arrangements shall be made to provide for the safety of the railway in accordance with the Rule Book GE/RT8000.

When the site is to be left unattended equipment protection shall be replaced (e.g. doors closed, covers replaced, etc.) and suitably secured. Details of any alterations to operational equipment shall be left available for reference by the maintenance staff.

Testing activities shall be arranged so that they do not prevent maintenance and operations staff gaining access to working equipment.

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4.2.6 Handover for Signalling Works Testing

The Tester in Charge is responsible for checking that testing does not commence until the affected equipment has been formally handed over from the Construction Manager. This shall include confirmation that the completed construction work meets the required quality standards.

Handover shall be in accordance with NR/L2/SIG/30014/C510.

4.3 Design Documentation

4.3.1 Outline Design and Documentation

The Tester in Charge shall be supplied with the outline design and documentation defining the Project.

Tester in Charge shall also be informed in writing of the Safety Verification category of the Project, as defined in NR/L3/RSE/100/02 in time to submit the Master Test Plan, which shall state this category, for acceptance in accordance with NR/L2/SIG/30014/C210.

4.3.2 Design Details

A complete set of approved Design Details shall be provided for the exclusive use of testing staff.

Copies of the engineering details to be used as the record of testing shall be identified with a “Test Copy” stamp not obscuring detail, or other uniquely identifying methods (e.g. a “Test Copy” watermark). These copies are commonly referred to as the Test Copies.

The production, format and version control of all engineering details issued for testing purposes shall be in accordance with procedures specified in NR/L2/SIG/11201.

The engineering details issued for testing purposes shall be issued far enough in advance to allow the Tester in Charge time to plan the testing. The engineering details may be issued for planning purposes as soon as they have been produced and need not be all issued at the same time. This is to allow the Tester in Charge to plan testing at the earliest opportunity.

The issue dates of engineering details shall be agreed between all the engineering parties involved and the outcome of this agreement shall be incorporated into the project programme.

Where it is necessary to carry out the changeover and / or commissioning of equipment in a series of specific packages during a particular stage of the work, the Test Copies for that stage shall clearly indicate the work to be done in each package, in accordance with NR/L2/SIG/11201. The Tester in Charge shall agree the method of presentation with the Responsible Design Engineer. The method of depicting the various packages shall be set out in the Test Plan.

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However, it is permissible for engineering details to be issued for the testing of specific Projects as detailed in NR/L2/SIG/30014/A210 that are not shown in red / green, but are just a clean copy of the record print, or a standard design, or a schedule. If engineering details are to be issued in this manner, then the agreement of the Tester in Charge, Responsible Design Engineer and Infrastructure Manager that this is an appropriate approach is required. The use of such engineering details shall be documented in the Test Plan.

4.3.3 Modifications

Once the engineering details have been issued any required modifications shall only be produced as an approved modification in accordance with procedures specified in NR/L2/SIG/11201. Such diagrams or modification sheets shall not be issued until the Tester in Charge has issued a Test Log number for each modification to the Responsible Design Engineer in accordance with NR/L2/SIG/30014/C410.

However, if the work detailed on the engineering details has not yet commenced, then it could be more efficient for the Responsible Design Engineer to recall all copies, and reissue suitably corrected up-versioned copies, rather than to use the modification process.

A single modification shall not affect more than one work site; a work site being a single indexed set of wiring diagrams or a single plan or schematic.

4.3.4 Closure List

A closure list shall be supplied to the Tester-in-Charge, which shall show the totality of the Test Copies issued as defined in NR/L2/SIG/11201.

The issue date of the closure list shall be agreed between the Responsible Design Engineer and the Tester-in-Charge, and shall usually be issued with the last issue of engineering details. The closure list shall normally be issued not less than 3 days prior to the commencement of commissionings classed as Simple, Complex or Signalling Electronic Systems Works, not less than 2 weeks prior to commissionings classed as Major Works, unless agreed to the contrary. There may also be circumstances when the closure list is required to be issued earlier.

Generally a single closure list shall be issued for a commissioning, and if a commissioning is divided into several stagework packages, a separate closure list shall be issued for each stagework commissioning. However, it is permissible to have an overall closure list issued for the testing of works such as those detailed in NR/L2/SIG/30014/A210.

Where the extent of the works to be tested and commissioned is such that a large number of signalling design diagrams are required, it is permissible to divide the design into work packages (e.g. track circuits and bonding, locations, Signal Sighting, cabling, interlocking, signalling control and display facility, stagework) and to issue a closure list for each work package. The division of the design into work packages shall be detailed in the design specification. Simultaneous issue of closure lists is not then required; in this case an index of closure lists shall be provided.

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A supplementary Modifications List shall also be issued to the Tester in Charge. This shall detail all modification serial numbers, including those issued during the commissioning itself, and the applicable Test Log number.

NOTE: the checking of the closure list is an essential pre-commissioning check to verify the completeness and integrity of the testing activity. In determining the closure list issue date, the Responsible Design Engineer and Tester in Charge need to balance the Tester in Charge's requirement to provide adequate time for the pre-commissioning audit to be effectively carried out, and the designer's desire to issue the closure list as late as possible generally due to timescale pressures. A pragmatic approach is needed to achieve an acceptable balance.

4.4 Testing Planning Documentation

4.4.1 General

The testing planning documentation shall cover the strategy, planning and implementation phases of the testing work. It is permissible for the phases to be documented either together or separately depending on the nature and size of the project.

Each Project shall be supported by a Testing Strategy (unless omitted due to a waiver as described in §4.4.2) and one or more Test Plans. Brief descriptions of these documents are given below. The selection of the documents required to record the testing arrangements shall be made by the Tester in Charge, and this selection is driven by the type of testing and commissioning required on the specific Project, and the programme of testing on a Project. Appendix B shows some typical document hierarchies.

"Test Plan" has been used in this document as a generic term, and refers to the testing document most appropriate to include the required information on any given Project. These documents comprise the Master Test Plan, Preparatory Test Plans, Test and Commissioning Plans, and Commissioning Plans. Supplementary documents such as Commissioning Task Sheets can also be used where appropriate.

It is permitted for testing planning documentation to be presented in a slightly different manner to the forms published as part of the NR/L2/SIG/30014 suite of documents, provided the contents and the numbering and order are maintained. The important issue is that each document is as easy to navigate and use as the form provided.

4.4.2 Testing Strategy

Each Project shall have a Testing Strategy, finalised at the Project specification stage (GRIP 4), and forming part of the outline design and documentation.

Testing Strategies shall be prepared in accordance with NR/L2/SIG/30014/C110.

Testing Strategies are subject to acceptance by Network Rail in accordance with NR/L2/SIG/30014/C210.

However it is permissible for the requirement for a Testing Strategy to be waived by Network Rail where this provides no benefit.

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Typical Projects where a waiver may be appropriate are:

- Projects that do not use the GRIP process;
- Projects that have used the GRIP process, but a Strategy is not produced prior to commencing GRIP 5;
- Projects that need to be completed in a short timescale;
- Projects that are sufficiently developed and have sufficient design issued to enable the production of the Master Test Plan.

Waivers shall be issued in accordance with NR/L2/SIG/30014/C210.

The Testing Strategy shall be superceded by the issue of the Master Test Plan.

4.4.3 Test Plans

Each Project shall have a Master Test Plan, which shall be developed from the Testing Strategy to provide an overview of the testing requirements of the Project.

As a general principle Test Plans shall be based on the outcome of discussions between the Tester in Charge and Test and Commissioning Engineer; the testing planning should not proceed as far as submitting a Test Plan for acceptance without such dialogue having taken place.

The Master Test Plan shall be the responsibility of the appointed Tester in Charge and shall be updated to reflect any major changes in the Project scope and / or requirements.

Testing activities shall be documented in detail in Preparatory Test Plan(s) and Commissioning Plans, or combined Test and Commissioning Plans. A schedule of Preparatory Test Plans, Commissioning Plan, and / or combined Test and Commissioning Plans shall be included in the Master Test Plan.

It is permissible for the detail required in the Preparatory Test Plan, or Test and Commissioning Plan to be incorporated into the Master Test Plan, thus avoiding the need for separate documents where this provides no benefit.

Plans shall be prepared in accordance with NR/L2/SIG/30014/C120.

Test Plans are subject to acceptance by Network Rail, or other infrastructure owner if applicable, in accordance with NR/L2/SIG/30014/C210.

4.4.4 Commissioning Task Sheets

Commissioning Plans can be supported by one or more Commissioning Task Sheets. Where used, these shall be prepared in accordance with NR/L2/SIG/30014/C120.

4.4.5 Post Commissioning Plan Addenda

Where disconnections of operational signalling are required to rectify deferred Test Logs, an Addendum to the Commissioning Plan can be produced to document the arrangements. Commissioning Plan Addenda shall be prepared in accordance with NR/L2/SIG/30014/C120. However, this is only permitted when the rectification works commissioning commences within 21 days of the original Entry into Operational Service date.

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4.4.6 Work Package Plans and Task Briefings

Work Package Plans and Task Briefing sheets shall be produced by the Project in accordance with requirements of NR/L3/INI/CP0044 to cover all Occupational Health and Safety issues. There is no requirement to repeat these items in Test and Commissioning Plans.

Similarly there is no requirement to repeat technical details within Work Package Plans or Task Briefing sheets. Instead a reference to the appropriate Test Plan can be included in these documents.

4.4.7 Test Specifications

All testing shall be carried out in accordance with the Defined Checks and Tests in NR/L2/SIG/30014/D115 and Test Specifications as detailed in NR/L2/SIG/30014/D120, except where detailed otherwise for Off Site Testing in §4.5.4.

4.5 Testing Process

4.5.1 Testing Personnel

4.5.1.1 Competence

The Tester in Charge shall be satisfied that all staff on testing duties are competent in accordance with NR/L2/SIG/30014/B410. This requirement shall apply for the planning, specification, and execution of the testing activities.

4.5.1.2 Undue Pressure or Coercion

Any undue pressure or coercion shall be reported to an independent party, for example the Tester in Charge, Infrastructure Manager, CIRAS, etc.

4.5.1.3 Independence

Independence of testing shall be achieved. Staff who have participated by direct preparation, direct advice or direct control of that particular design or installation, shall not assume testing responsibilities except where permitted below. Staff, however, are permitted to undertake any testing responsibilities for any other part of the Project in which they have had no direct involvement.

Independence is not required for:

- Module 5 Test Assistant duties;
- Module 3D Verification Testing;
- In the case of design staff only, module 3A or 3C Verification Testing;
- Module 4 Trackside Function Testing, correspondence testing only.

NOTE: When the installer responsible for the installation is assisting the testing function then care shall be exercised to confirm that the necessary independence of thought (e.g. in reporting a wire count) is not compromised.

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