

Sydney Trains



Engineering System Integrity
Engineering Procedure
Signalling and Control Systems

PR S 47112

Inspection and Testing of Signalling: Plans, Programs, Documentation and Packages

Version 1.2

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Engineering System Integrity

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Document control

Version	Date	Author/Prin. Eng.	Summary of change
1.0	8 March 2019	E Pace	New document based on old RailCorp document SPG 0711.2
1.1	25 January 2021	Adam J Bird	Scheduled review
1.2	7 December 2021	Ian Maydew/C Darmenia/Adam J Bird	Inclusion of axle counter requirements. Minor update to Section 2.5 and 11.6.3 with removal of Digital COC and replaced with Digital IMC. Section 3.1 Updated for the inclusive of ETCS L1 LS Certification Documents

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Summary of changes from previous version

Summary of change	Section
Updated "References" section	1.2
Updated "Digital IMC" replace "COC"	2.5
Updated for inclusion of ETCS L1 LS Certification documents	3.1
Include reference for Point History cards	9.6.9, 9.10.6.2, 9.10.6.15
Replace waiver with concession or deviation or both	8.8, 8.10, 9.2.6.4, 9.2.6.12, 9.5, 11.6.1.2
Incorporated axle counter requirement, Wheel Sensor History Card and use of rail vehicle detection to cover both track circuits and axle counters where applicable	3.1, 3.7.5, 4.2.1, 4.2.1.1, 5.1, 8.10, 9.6.2, 9.6.9, 9.10.6.2, 9.10.6.15, 11.6.1.2
Updated "Interim Maintenance Copies (IMC)" section	11.6.3

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1 Introduction

1.1 General

This document defines the planning, programming, documentation and work packages required for the inspection and testing, quality of installation and commissioning work necessary for safety assurance of new and altered signalling works on Transport for New South Wales (TfNSW) infrastructure.

The requirement is for the implementation of an effective, proven auditable process for verification and validation of the safety integrity of the signalling system and verification of compliance of the new or altered system to Sydney Trains Engineering Principles and Standards. The process shall include the retention of the records providing objective evidence of the planning, implementation and evaluation of the inspection, testing and commissioning.

The verification and validation process shall include:

- Clear definition and communication of responsibilities.
- Detailed and comprehensive planning and programming.
- Detailed and comprehensive site design and investigation.
- Application of proven inspection and testing practices by licensed, experienced and competent personnel, using appropriate, calibrated test equipment.
- Monitoring and control of progress, detailed recording of results.
- Adherence to Signalling Safeworking Procedures and Network Rules and Procedures.
- Implementation of an effective quality management system.

With the total verification and validation process fully documented and rigorously followed.

This document, in conjunction with the other PR S 471XX series documentations, defines such a verification and validation process:

1.2 References

This document shall be read in conjunction with:

PR S 47110 Inspection and Testing of Signalling: Introduction

PR S 47111 Inspection and Testing of Signalling: Roles, Responsibilities and Authorities

PR S 47112 Inspection and Testing of Signalling: Plans, Programs, Documentation and Packages

PR S 47113 Inspection and Testing of Signalling: Inspection and Testing Principles

PR S 47114 Inspection and Testing of Signalling: Inspection and Testing Procedures

PR S 47115 Inspection and Testing of Signalling: Typical Inspections and Tests for Signalling Apparatus

PR S 47116 Inspection and Testing of Signalling: Interface Requirements and Procedures for Alterations

PR S 47117 Inspection and Testing of Signalling: Standard Forms

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PR S 47120 Inspection and Testing of Signalling: ETCS Level 1 Limited Supervision Integration of Trackside Alterations

PR S 40004 Failures

PR S 40022 FM01 Signal Apparatus - Mechanical/Relay/Route Control Locking Test Certificate

PR S 40022 FM02 Signal Apparatus - Design Integrity Test Certificate

PR S 45006 ETCS L1 LS Data Design Process

PR S 45009 ETCS L1 LS Trackside Design Process

2 Design Document Control

2.1 Signal Design

All persons, whose duties require them to manage, distribute or use signalling design documentation shall ensure their preservation and safekeeping. These documents shall only be made available to those who need to access them in the normal course of their duties or as permitted by the Professional Head Signalling and Control Systems.

Rigorous control of signalling design is fundamental to the safety integrity of the signalling system. Control issues can be contributing factors in safety related incidents.

Installation work shall not commence until there has been a job status review and inspection with the Regional Signal Representative including the status of other modifications/jobs issued for the area with particular emphasis on:

- Jobs that are currently issued and either not or partly completed.
- Any assumptions included in the approved design regarding the status of previous jobs.
- Any updates for previous jobs outstanding in the local “Maintenance Copies”.

Construction personnel shall be on the lookout and advise the Commissioning Engineer if they find evidence of unaccountable or aborted work in the area.

Details of the required procedures are found in *PR S 47116 Interface Requirements and Procedures for Alterations*.

Work to bring into use new or altered Signalling shall not proceed until there has been a status review performed and documented in the Site Integrity Agreement section of the Interface Coordination Plan.

2.2 Control of Signing Design Documentation

Signal design and Control Systems design shall be prepared, presented and used in accordance with Specification *SPG 0703 Signalling Documentation and Drawings*, the relevant design office quality procedures and generally as follows:

The intent of documentation control is to:

- Identify the documentation that details the designed configuration of an installation, at a specific time.
- Methodically manage authorised alterations to that configuration.
- Clearly match, review, verification and approvals to the design.

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2.3 Control Mechanism

The basic techniques used to manage signals documentation are:

- A unique circuit book and page number on every page.
- A version date on every page that is altered each time the design on that page is altered.
- A job number on every page.
- Every distinct commissioned configuration is to have a different job number (including stage work). Conversely, all documents for each commissioning event must have the same job number.
- A control sheet that lists all pages of all documents (including signalling plans, track insulation plans etc.), the version date of each sheet or document, and the version date of the control sheet.
- Highlighting and version dating changes to a sheet.

The basic techniques used to manage Control Systems documentation are:

- A unique circuit book, or circuit sheet and page number on every page.
- A version date on every page that is altered each time the design on that page is altered.
- Every distinct commissioned configuration is to have a different job number (including stage work). Conversely, all documents for each commissioning event must have the same job number.
- A 'Release' document that details the revision of the changed software/data and/or hardware configurations.

2.4 Rules of Documentation Control

Implementation shall be as follows.

2.4.1 Coloured Issues

The process supports the issue of coloured documentation for the various construction phases. When updating a design from green to pink to yellow, it is NOT necessary to change the sheet version date unless the design has been altered. The adding of detail by field personnel to clarify or further detail a design is NOT a change to the design. However should wiring be physically altered, this is a design change and the alteration, must be given a new version date and updated control sheet, and review, verification and approval signatures.

When updating between colours, the front cover of the circuit book is signed to indicate the stage. The control sheet is not altered unless the design has changed as noted above.

2.4.2 Alterations to the Design

When an issued design is to be altered, the original version date on the sheet is to remain legible, but neatly crossed out. The altered area is to be clouded and the cloud is to receive the new version date. It is often preferable that these changes are neatly drawn by hand, as this makes them more obvious. A new control sheet with the changed sheets version dates including the updated version date is provided. Review and Verifiers are to check the alterations before approval. It will not be necessary for these checkers to recheck the whole design. They are only signing for the particular change version dated on that control

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sheet. However, they are responsible for ensuring that all elements of the change are correctly altered to the extent that the change requires.

2.4.3 Amending Documentation with Updated Sheets

Any documents where new sheets are issued together with a new approved control sheet are to be updated by the insertion of the new sheets into the book. Old versions of the updated sheets may be retained in the book but **MUST** be cancelled by drawing a red line diagonally through the page. Old versions of the control page must also remain in the book, as these are the records of the review, verification and approval signatures for the original elements of the design. However, these should also be cancelled by drawing a red line diagonally across the page. These signatures are still valid for the unaltered parts of the job.

2.4.4 When is Version Control Implemented?

While the design documentation is held within the design office and within the design team, version control need not be in place.

However, version control does need to be in place when:

- The design is compiled for verification i.e. checking of the documentation control is one aspect of the work the verifier must ensure is correct. The reviewer need not version control until the reviewer is satisfied the work is complete and ready to proceed to verification.
- The design is issued as a “Proof” or “Draft” copy (whether reviewed or verified, or not).

2.4.5 Changes to Previous Changes

Should further alterations be required on a sheet that already contains alterations, the following shall occur:

- The previous changes would be clouded and version dated.
- This version date should be crossed out (but remain legible) and the cloud removed.
- The new changes are made and these clouded and the sheet given a new version date.
- The control page is updated and the alteration approved as described before. In order to record the previous state of the design, the previous sheet remains in the book “cancelled”.

2.4.6 Changes after Wiring has commenced

In general, changes to the design do not have to show wires that were to be “new”, shown as removed, in the update. This is because if the wiring has not commenced, the wires are not in place and hence do not need to be removed. However, once wiring has commenced, it is important that any unnecessary wires run are removed. If these wires are contained fully in new work (e.g. a parallel contact), then they are easily missed. In these circumstances, the usual wires removed and wire to be run “new” should be shown highlighted by the hollow and solid arrows respectively.

2.4.7 Design and Commissioning Engineers to Consult

When an altered design is to be issued following the commencement of construction, it is important the Commissioning Engineer has a clear understanding on the extent of the

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changes. To ensure there is a clear understanding of what is required; Signal Design Engineers and Control Systems Design Engineers shall consult with the Commissioning Engineer in order to clarify:

- The scope of alterations to the design and equipment changes.
- The extent to that wiring changes will be required.
- The extent of changes to the planning, design integrity or site testing.

2.5 Role of Commissioning Engineer

The Commissioning Engineer shall prior to commissioning ensure:

1. That the design is up to date with the latest control sheet, and all pages are correct to that control sheet.
2. Control Systems data/software is correct to the approved 'Release' document.

Further, verify that testing has been planned or completed to the latest versions.

The Commissioning Engineer shall include and maintain version control within the "Register of Working Drawings" included in the Installation and then the Commissioning Work Package.

On completion of the commissioning (or prior for ETCS L1 LS/ASDO works) and as soon as reasonably possible, a digital copy (pdf) of the Interim Maintenance Copy (IMC) shall be emailed to the signal design team.

Following the works, the Commissioning Engineer shall return all Certified Office Copies (C.O.C's) of the design as soon as is practicable (nominally within 28 days) following the completion of the works. Should this not be possible, Commissioning Engineers shall consult the Professional Head Signalling and Control Systems.

2.6 Use of Modification Sheets

Modification record books shall comply with the requirements of Specification *SPG 0703 Signalling Documentation and Drawings*. The use of modification sheets may introduce risks to document control. They should only be used during commissioning, when the preparation of the designs in the formal way and the use of formal control sheets are impractical. On each occasion a modification sheet is issued the Signal Design Engineer and/or Control Systems Design Engineer shall consult with the Commissioning Engineer.

Commissioning Engineers are to ensure all modification sheets are recorded in the Commissioning Work Package "Register of Working Drawings" and the commissioning log and that a copy of the completed modification sheet is securely attached into the C.O.C or Control Systems 'Release' document.

Signal Design Engineers and Control Systems Design Engineers shall ensure that office copies of modification sheets are attached into the office copy as soon as they return to the design office.

Commissioning Engineers are to ensure that interim maintenance copies of the design are marked up to include details of any commissioning or post commissioning modifications.

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2.7 Distribution of Signal Design Documents

Signal Design shall be issued via the Regional Signal Representative. The Regional Signal Representative shall include the design in the Regions document register then issue numbered copies to the Commissioning Engineer for the works.

At the time of commissioning, the Commissioning Engineer is to ensure that any required changes are made to the IMC copies and returned as agreed with the Regional Signal Representative.

Review copies and C.O.C's being returned to Signal Design for updating or interim maintenance documents from the Commissioning Engineer shall be returned via the Regional Signal Representative.

The Regional Signal Representative shall promptly transfer the documents and obtain transmittal receipts as a record of each document transfer.

The Regional Signal Representative shall distribute interim maintenance copies to the required maintenance locations prior to the first peak following the commissioning and promptly return C.O.C's to design.

2.8 Distribution of Control Systems Design Documents

The Control Systems 'Release', hardware and software design shall be issued via the Control Systems Design Manager.

2.9 Site Control of Design Documents

Design documentation shall be registered, controlled, carefully and systematically stored and protected from damage, kept on Sydney Trains premises in the vicinity of the works and available for audit at all times.

The colour design phases are "Blue" Review, "Green" Approved for Construction, "Pink" Approved for Testing, "Yellow" Approved for Commissioning/C.O.C/Interim Maintenance and "White" Maintenance Copies.

The Commissioning Engineer shall analyse the program and available resources and advise the 'Regional Signal Representative' and 'Control Systems Operations Manager/Representative' the number of site copies required to be issued by Signal Design and Control Systems Design of the construction, testing and commissioning documents including the Control System 'Release' document. Each received document is entered into the "Register of Working Drawings" in the Work package.

One of each green and pink document shall be designated as "Construction or Testing Master" respectively, Commissioning and Test Engineers shall progressively mark-up clarifications and detail for return to design. These mark ups shall be limited to minor non-functional changes to equipment, track or trackside features, set out or site location, equipment layouts, termination numbering details and cable core allocation changes. Design shall incorporate agreed construction clarifications and details into the commissioning drawings.

Proposed site set out and functional changes for example; track circuit lengths, relocation of trackside equipment, equipment types, relay contact allocations during the blue, green or pink phases shall be agreed with the designer prior to implementation and marked up on the master. The Signal designer is responsible to incorporate these changes into the next version issue of the signal design documentation. The Control Systems designer is responsible to incorporate these changes into the next version issue of the Control Systems design documentation. Functional changes occurring after the issue of "Yellow"

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phase documents shall initiate the re-issue of a new version of the affected portion/s of the design.

The total design for the new and altered signalling works shall be inspected, tested and certified to registered “Test Copy” set/s of the design (Yellow or Pink) that are the primary auditable record of the inspection and testing achievement.

All testing documents shall be clearly and permanently marked as to the area or locations they are allocated for use. As each testing set is issued, the details are updated to include the name of the Signals or Control Systems Test Engineer responsible for its implementation and safe keeping. Where more than one test copy is required, each circuit that is common between the areas shall be clearly segregated by marking (clouding or dividing lines) to define the testing interface in each book. A suitable independent delegate shall perform a check to ensure that the interfaces are consistent between copies and are clearly marked to show what is and what is not nominated for inspection and testing in each book.

The progress of the testing shall be monitored. The status of what has been completed and what is still to be done shall be clearly visible.

Each person conducting inspection and testing shall provide on each document their printed name, signature and sample of their unique testing colour and if applicable their distinctive marks.

For circuit testing, as each circuit or item is inspected and tested, each completed or partly completed sheet is to be signed and dated by the respective Signal or Control Systems Test Engineer. Details of the testing activity performed shall also be provided “Bell Test/Wire Count and Insulation Tested”, “Null Count”, “Circuit Function Tested”, “Through Function Tested”, etc.

2.10 Design Issued with Portions Marked as "Please Certify"

Design may be issued prior to the yellow “Commissioning” stage that includes requirements for field certification of the as-built status of the signalling apparatus and/or circuits.

If any design document is marked “Please Certify”, the apparatus or feature is to be verified in the field prior to the alteration proceeding and initialled in the C.O.C. Circuits or portions of a circuit marked “Please Certify” shall be bell tested and wire counted to verify the design and the design office formally advised of the outcome. This advice shall be in the form of an attested copy of the “approved for construction” design marked with changes or certified as being compliant by the Commissioning Engineer. The Commissioning Engineer may authorise verification of “Please Certify” by a directly supervised correlation check if the hand tracing is unobstructed and the wiring condition is safe and free to manipulate.

2.11 Site Control at Pre-Commissioning Phase

At the completion of pre commissioning testing the Commissioning Engineer (or delegate) shall; closely examine (countersign and date) the completed “Test Copy” documents to verify that each and every activity of inspection and testing has been completed, correctly marked up and signed off by the testing engineer/s and assistants. Further, the check shall include that all testing clarifications and details have been correctly transferred to the testing masters.

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Residual testing, changeovers and certification inspection and testing to be completed during the commissioning:

- Where the design is issued initially at the approved for commissioning “Yellow” phase, the document/s used for the pre-commissioning inspection and testing shall be used to record the completion of inspection and testing during the commissioning.
- Where pre-commissioning testing is conducted using testing “Pink” documents; upon receipt of the approved for commissioning “Yellow” design, check that the version number/s have not changed – for these documents inspection and testing may be completed using the original pink documents. This is preferred as it simplifies final checking to verify testing completeness. If the version number has changed:
 - Draw a line through and mark any superseded pink approved for testing documents/sheets as “Superseded” and retain.
 - Identify the extent of any new and outstanding (from the pinks) inspection and testing requirements. Allocate, clearly mark and register “testing copies” of the approved for commissioning “Yellow” design. Mark up (cloud) the extremities of the required inspection and testing and any changeovers associated with the changes associated with the version change. For clarity the testing engineer may be given access to or provided with the original “superseded” pink testing copy.

2.12 Site Control at Commissioning Phase

Document all outstanding inspection and testing requirements in the Inspection and Testing Plan. Implement these inspection and testing activities using detailed Commissioning Work Instruction/s.

All Signalling design changes during the commissioning shall be authorised utilising discretely numbered Modification Instruction Forms as described in Specification *SPG 0703 Signalling Documentation and Drawings*. Each Modification Instruction Form shall be issued to the Commissioning Engineer and included in the Register of Working Drawings in the Work package. The test copies of the implemented Modification Instruction Form shall be attached to and used to update and include the details in the affected Interim maintenance and C.O.C.

The C.O.C shall be marked up with any construction or testing amendments, commissioning modifications attested and Certified by the Commissioning Engineer to be a true and accurate record of the “as commissioned” design.

2.13 Site Control at Post Commissioning Phase

C.O.C. of design shall be returned via the Regional Signal Representative or Control Systems Commissioning Engineer within 28 days to the Professional Head Signalling and Control Systems following completion of certification inspection and testing of the design.

Following completion of the works, design documents, inspection and testing plans/work packages used for quality and inspection and testing certification shall be archived as per the Sydney Trains policies and procedures.

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3 Certification Documentation

Ensure that inspection and testing certification documents are reviewed, checked, and signed by qualified, licensed persons attesting that the design, data change, product or installation is in accordance with the Specification requirements as proven by appropriate inspections and/or tests.

Signals Engineers shall ensure that each element of the signalling installation is correctly inspected, tested and signed for.

Control Systems Engineers shall ensure that each element of the control systems installation is correctly inspected, tested and signed for.

3.1 Certification Documents

3.1.1 Design

The essential certification documents for inspection and testing for signalling safety, reliability, and functionality are the final approved design signalling plans and drawings. Requirements are stipulated in Specification *SPG 0703 Signalling Documentation and Drawings*.

Testing copies of the following design documents shall be marked and signed in an approved, standard manner certifying that the installation has been inspected and tested and conforms strictly with the design:

- Signalling/Track/Balise Plan
- Track Insulation Plan
- Signalling Circuit Book(s)
- Working Sketch
- Locking Table and Locking Diagram
- Control Table
- ETCS Tables (refer to PR S 45009)
- ETCS L1 LS Exported Test Cases (refer to PR S 47120 and PR S 45006)
- Design Integrity Test plan (including Data Release Note, refer to PR S 45006)
- Interlocking Tests
- Control Systems Circuit Book(s)
- Configuration Scripts
- Control Systems design report/document(s)
- Control Systems Release Document
- Data Build(s)
- FAT and SAT Test Plans.

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3.1.2 Adjustment

Ensure that the following document certifications are performed:

- Points facing point lock and detection adjustment tests shall be specifically certified on Facing Point Lock and Detection Test Certificates.
- Rail vehicle detection system adjustment tests shall be specifically recorded and certified on:
 - a. Track Circuit Master Sheets for track circuits, and
 - b. Wheel Sensor History Cards for axle counters.
- Correct adjustment of adjustable electrical contacts on operating mechanisms shall be certified in the circuit book as part of the inspection and tests to the circuit wiring diagrams.

3.1.3 Insulation

Ensure that Insulation Test results are specifically recorded and certified on the circuit diagrams and Cable Insulation Record sheets.

3.1.4 Clearances and Positional Relationships

Ensure that structure gauge clearances, train stop gauging, etc. and positional relationships between apparatus, e.g. Signal/train stop/block joint or axle counter wheel sensor and clearance point to block joint or/axle counter wheel sensor, are included as part of the certification inspection to the Signalling/Track Plan, Working Sketch and Track Insulation Plan.

Train stop gauging shall be certified on a separate Test Certificate.

3.2 Interlocking Certification

Perform a test of interlocking between points, signals, etc. the Signal Design Engineer or Commissioning Engineer carrying out the interlocking test shall sign the Interlocking certification.

Interlocking tests shall be specifically certified on Interlocking Test Certificates as nominated in *PR S 40022 FM01 Signal Apparatus - Mechanical/Relay/Route Control Locking Test Certificate* and/or *PR S 40022 FM02 Signal Apparatus - Design Integrity Test Certificate*.

3.2.1 Axle Counter Reset Test

Reset tests shall be captured as part of Interlocking testing.

Perform a reset test of axle counter track section/s to ensure any prescribed reset types can be successfully implemented.

3.3 Signal Design Tests

Where more than one Signal Design Engineer is involved in design function testing, nominate a Senior Signal Design Engineer to control and coordinate the design function tests and to ensure that all the tests are completed. Each Signal Design Engineer is to sign off (certify), in an agreed unmistakable manner, only those tests that he/she has certified. Detailed handover procedures shall apply for shift working.

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3.4 Control Systems Site Acceptance Tests

Where more than one Control Systems Test Engineer is involved in testing then a Control Systems Test Engineer shall be nominated to control and coordinate the testing activities and to ensure that all the tests are completed.

Each Control Systems Test Engineer is to sign off (certify), in an agreed unmistakable manner, only those tests that he/she has certified. Detailed handover procedures shall apply for shift working.

3.5 Complete Testing

Ensure that there is no alteration or interference, intentional or inadvertent, to the installation once the testing, on which the certification relies, has been performed.

Should any modification take place then ensure that it is appropriately authorised, that the alteration work is strictly controlled, and that the installation is correctly and comprehensively retested and certified to the extent necessary to ensure the integrity of the installation.

3.6 Other Documentation

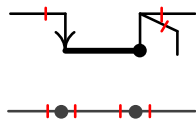
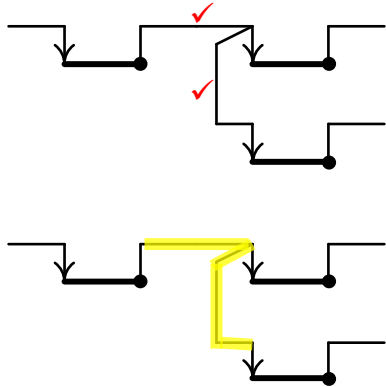

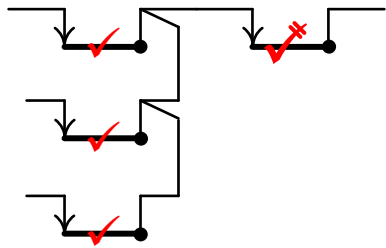
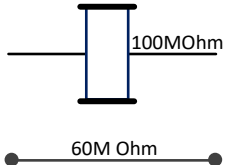
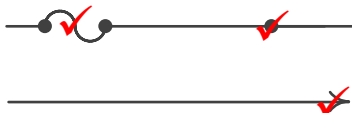

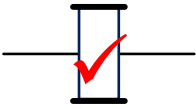
Refer to the Specification *SPG 0703 Signalling Documentation and Drawings* for details of further requirements for New and altered works.

3.7 Method of Recording Tests on Design Drawings

See next page.



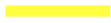
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3.7.1 Recording on Circuit Book Sheets




<p>Wire count denoted on circuit diagram by small stroke across the wire next to the terminal</p>	
<p>Bell continuity test denoted on circuit diagram by small tick next to the wire or by marking the wire with a highlighter</p>	
<p>Circuit strap and function test of a contact denoted on circuit diagrams by a large tick through the contact</p>	
<p>Contact strap and function test for more than one parallel path denoted by stroke across large tick for each additional path</p>	
<p>Circuit insulation testing denoted on circuit diagram by recording test reading next to the circuit function for complete circuits or on individual circuit wires where applicable</p>	
<p>Circuit function test of fuses and link terminals denoted on circuit diagram by large tick through fuse or terminal</p>	
<p>Correct busbar voltage denoted on circuit diagrams by small tick next to the supply details</p>	
<p>Circuit function test of a relay denoted on circuit diagrams by a large tick through the relay</p>	

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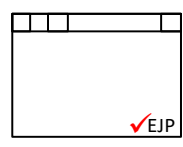
3.7.2 Recording on Analysis Sheets

Relay type and pin code analysis check denoted on contact analysis sheet by large tick	<p>QN1 12-4</p> 
Analysis check of each entry on the analysis sheet denoted by small tick (or highlight) on each and every entry including spare contacts, wires and terminals (Null Count)	 


3.7.3 Recorded on Control Tables

Function test denoted by large tick	
Through testing of contacts (e.g. tracks in auto signals denoted by T symbol	
Aspect check denoted by large tick	

3.7.4 Recording on Circuit Book Sheets

Sheet fully tested denoted by large tick in the bottom right-hand corner with testers name, signature and date	
--	---

3.7.5 Recording on Signalling Plans and Track Insulation Plans

Inspection denoted by large tick against the item checked e.g. signal, track circuit or axle counter section limit, etc.	
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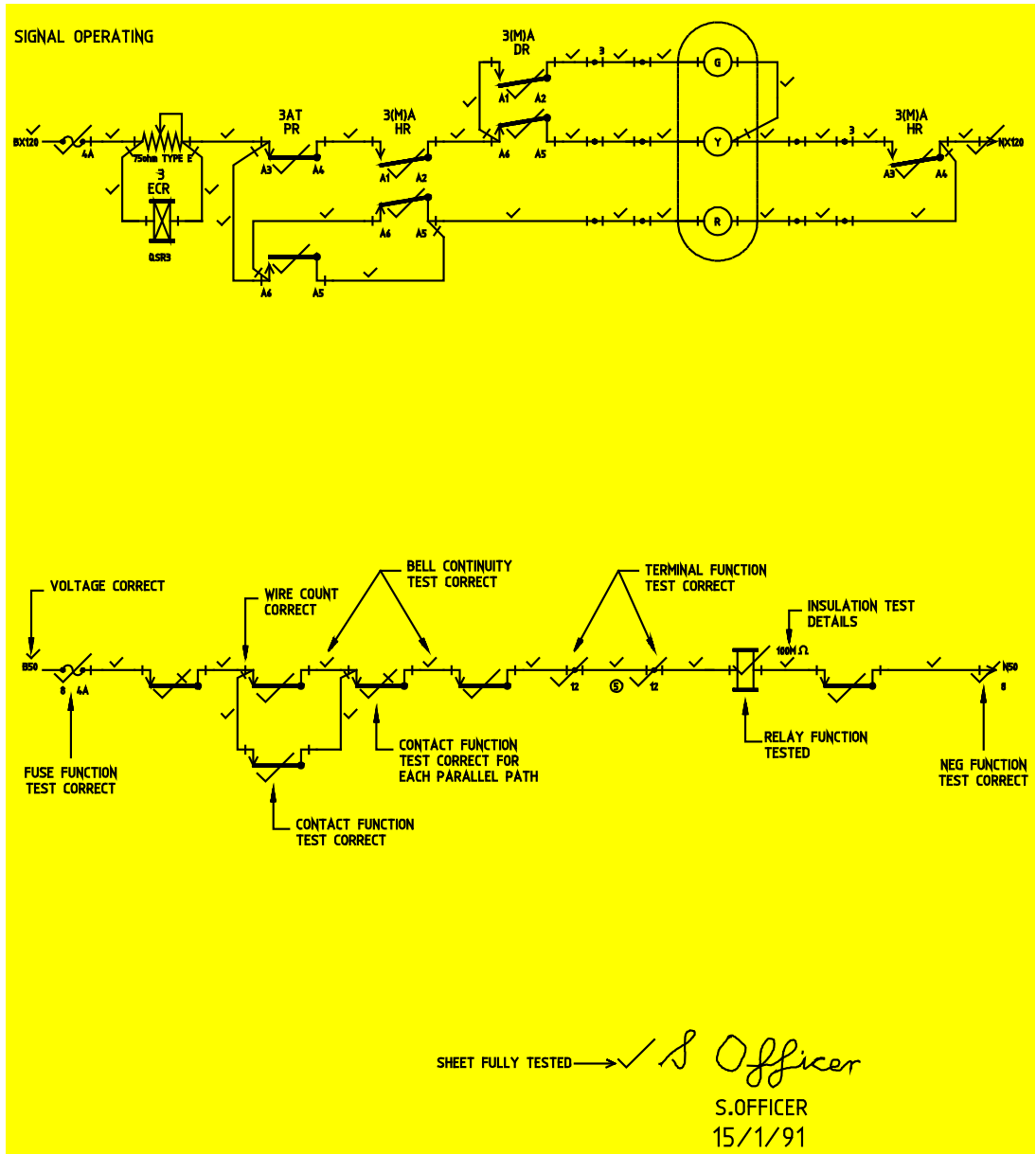


Figure 1: Example of marking of circuit book sheets

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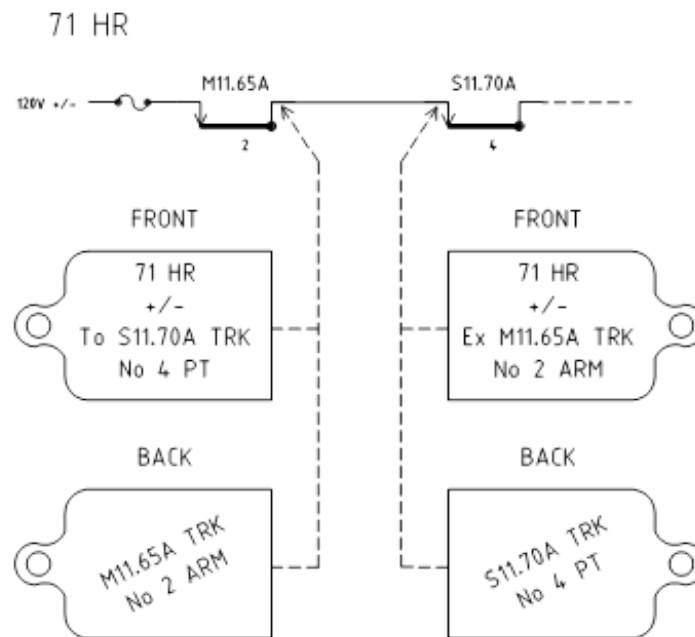


Figure 2: Example of paper tag identification labels for wires

3.8 Procedure for Recording Aspect Sequence

Record and certify aspect sequence tests on the Control Table and/or the Signalling/Track Plan.

Also, complete and sign off the Certification Inspection and Testing Checklist for Aspect Sequence Tests.

3.8.1 Control Table

Where Control Tables are utilised for recording aspect sequence tests, each aspect test must be marked off in the appropriate column of the Control Table by the Testing engineer.

3.8.2 Signalling/Track Plan

Where Signalling/Track Plans are utilised for recording aspect sequence tests, each tested aspect must be marked off on the Signalling/Track Plan clearly by drawing a line through the signal aspect symbol.

The train stop normal and reverse conditions should be marked off as correctly tested by a vertical line and a horizontal line over the train stop symbol respectively.

3.8.3 Aspect Sequence Test Form

For every signalling area tested, a Certification Inspection and Testing Checklist Form for aspect sequence tests should be filled in and signed off by the Test Engineer verifying that the tests are complete and correct.

If more than one Test Engineer is involved, each Test Engineer shall be designated a different colour indelible marker to identify the tests carried out by them.

Each Test Engineer shall sign off the Control Table and/or the Signalling/Track Plan to certify their tests using their designated colour indelible marker.

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3.9 Certification and Design Integrity Testing Documentation

At the completion of design integrity testing the Design Engineer provides the Commissioning Engineer a copy of the signed off Design Integrity Test Plan and any required interlocking test certificates.

After the commissioning, the certified documents including the design Integrity Test Plan, Control Table and/or the Signalling/Track Plan used for marking off the aspect sequence shall be archived in accordance with the directions nominated by the Professional Head Signalling and Control Systems.

3.10 Control Systems FAT and SAT Documentation

At the completion of FAT/SAT testing the Control Systems Test Engineer provides the Commissioning Engineer a copy of the signed off FAT or SAT Plan and any required test certificates.

After the commissioning, the certified documents shall be archived in accordance with the directions nominated by the Professional Head Signalling and Control Systems.

4 Requirements for Construction Documentation

4.1 Construction Design Document Control

Construction documents shall be registered, controlled, carefully and systematically stored and protected from damage, kept on Sydney Trains premises and available for access at all times. Following completion of the works the documents used for construction inspection and testing and quality certification shall be archived for the life of the commissioned infrastructure or in accordance with the current system nominated in the Sydney Trains policies and practices.

4.2 Construction and Site Design Documentation – General

For each job involving new and altered Signalling, construction documents shall be produced, registered and approved as nominated including:

- Project Work Notification and Interface Coordination Plan in accordance with *PR S 47116 Inspection and Testing of Signalling: Interface Requirements and Procedures for Alterations*.
- Program of Works for the construction, Inspection, testing and commissioning encompassing the preparation, implementation and evaluation phases of the project.
- Inspection and Testing Plan.
- Installation, Commissioning and Handover Documentation Work Packages or for smaller works and when agreed a Minor Work Package.
- Equipment Registers.
- Quality Assurance as further nominated in the Sydney Trains Quality Management System.

Further, construction design documents in accordance with Specification *SPG 0703, Signalling Documentation and Drawings*, as applicable to the detailed scope of works shall be produced, approved and the “as built” installation work certified to comply with:

- Detailed Site Survey Drawings

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- Signal Sighting Checklist & Forms
- Installation Drawings
- Equipment Housing Layout Plans
- Mechanical Drawings
- Structures and Buildings
- Clearance Diagrams
- Level Crossing Layout Plans
- Airline schematic and Detailed Installation Drawings
- Drivers Diagrams and Weekly Notice Insertions.

All the above documents and electronic copies of the documents shall be updated to “as built”, electronic and three hard copies provided to the Regional Signal Representative and/or respective Control Systems Maintenance Engineer as part of the Handover Package.

The intent is to produce and utilise a formal planning, implementation and handover documentation system for the scope of the works that provides an auditable record of all the quality, inspection, testing and certification verification and validation activities.

Each time any inspection and testing plan or work package is commenced, it shall be registered with the Project Manager who will issue the registration number.

PR S 47117 Inspection and Testing of Signalling: Standard Forms, contains examples of typical work package forms, work instructions, inspection and testing certification forms, inspection and testing checklists and the Interface Coordination Plan.

The Sydney Trains Infrastructure Engineering Specifications – Signalling set out the requirements and methods of recording testing.

The above construction documentation, work packages, test certificates, work instructions and check-lists, shall provide objective evidence to demonstrate that all quality, inspection, testing and certification activities have been fully planned, implemented and evaluated.

Prior to the commencement of any construction works that will be hidden/covered up or buried an approved, inspection and testing plan and installation work package shall be available and implemented on site.

4.2.1 Detailed Site Survey Drawings – General Requirements

Work as executed plans (Detailed Site Surveys - D.S.S) shall be produced for all new and altered Signalling works. Detailed site surveys shall be produced in accordance with *SPG 0703 Signalling Documentation and Drawings* including Appendix D that contains sample layouts.

Detailed site survey data and process shall be as nominated therein or alternatively interim arrangements as agreed with the Regional Signal Representative during the scope development phase.

The basic process is for the integration of services searches, detailed site surveys, Signalling site construction set out planning and implementation then work as executed documentation:

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- The Regional Signal Representative shall collaborate for the provision of detailed site surveys for the work, including:
 - Provision and use of previously developed D.S.S data and information.
 - Provision and conditions of use of services search information held and maintained by the Regional Signal Representative.
 - Responsibility and methodologies for the location, marking, survey, updating of service search information.
 - Any exclusions (and limits of exclusions) for the work for the provision of detailed site surveys requirements as specified herein. Details of process to be used when an alternative interim system is to be used.
- Initial surveys shall include services searches to identify existing services both above and below ground. Further, identify earth potential rise zones around high voltage earths such as at substations and high voltage transmission line poles. Maximise and nominate on the D.S.S drawings the Signalling earthing separation zones to be maintained. Refer to the Signalling Surge Protection Guidelines for further information.

Using this base plan, in consultation via the Regional Signal Representative to the responsible regional civil, electrical and geotechnical representatives plan the required construction work considering:

- Safe systems of work based on the assessment of the known and construction risks.
- Structural or geotechnical consultation and approvals.
- Maintaining separation from existing underground and above ground services, provision of separate cable routes for new power feeders from power poles to Signalling locations.
- Site access during and following the work.
- Maintenance access to the new trackside signalling equipment including safe access provisions such as walkways, handrails and steps.
- Current and future works.
- Types and extent of cable routes to be provided.
- Locations of equipment, structures, buildings, equipment housings, rail vehicle detection track section limits, foundations, cable routes, under-track crossings and all like work.
- Locations sizes, type and layout of airlines including; mains, cross ties, manifolds, reservoirs, anchors, expansion joints, insulated joints, filters and lubricators, separators, auto drains, valves, pressure gauges, compressors, orifice plates, regulators, flexible air hoses, under-track crossings and all like work.
- The installation drawing/s detailing each site construction layout shall be nominated throughout the drawings.

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4.2.1.1 Interim D.S.S Requirements

Where interim detailed site surveys are to be provided, the requirements shall be as follows. Maximum compatibility with the GIS/CAD requirements shall be provided including the methods of obtaining survey data and plan registration. The provisions of the GIS/CAD requirements shall have precedence.

The content of DSS drawings shall be kept to manageable areas and shall be numbered to form a logical pattern. An overall index shall be provided.

The software version of the detailed site survey drawings shall be drawn at 1:1 scale and plotted to the required scale on A3 paper. All text and symbols are to be legible when plotted on A4 paper. In very complex areas, the vertical scale may be abandoned but all vertical dimensions must be shown to the relevant track side equipment. One hundred-metre sections plotted to a scale of 1:250 is preferred in most cases but scales of 1:200 and 1:500 are permissible.

Where mapping files are available, these are to be used as a basis for detailed site surveys.

The cable route is to be drawn continuous in manageable proportions with borders abutting to facilitate the insertion in a master drawing.

DSS drawings shall include full dimensions to fix from unaffected structures the location of every kilometre and half kilometre post, cable routes, underline crossings (ULX's), station buildings, signal boxes, relay rooms, housings, location cases and lineside equipment with reference to the running face of the nearest railway line and, where applicable, existing buildings which are to remain and/or overhead wiring structures.

DSS drawings shall also show those existing items which affect the construction of the new works, and which are subsequently to be removed. After removal, they shall be deleted from the as built drawings.

Lineside equipment shall include but not be limited to signals, trainstops, points, catch points, insulated rail joints, axle counter wheel sensors, warning lights, guards indicators, notice boards, ground frames, releasing switches, point indicators, level crossing lights and boom posts.

DSS drawings shall also include the following information:

- The location of all creek, road, rail and river crossings, under-bridges, overbridges, tunnels, top of platform ramps, canals, viaducts, drains, culverts, railway cuttings and embankments, retaining walls, etc.
- The locations of all access roads and public level crossings.
- The location of all telecommunications equipment such as telephones, exchanges, public address systems. This includes external telecommunications providers/suppliers,
- The location of other services such as water, sewerage, stormwater drains, gas mains, telecommunications cables, power authority underground cables and overhead wires.
- The location of rails and OHWS.
- The location of points and crossings.
- Any applicable site installation drawing/s numbers shall be shown at the location to which they apply.
- Cable Routes.

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The DSS drawings shall show the following information with respect to cable routes:

- The location of all cable and air main routes with respect to the nearest rail and any other major structures. The maximum distance between reference measurements, even on cable routes that are parallel to the track for long distances, shall be fifty (50) metres. The distances from fences can be shown as an additional reference but these shall not be used as the only reference measurement, as the position of fences may change over the years.
- The distance from each over-head wiring structure (OHWS). Each structure identification number shall be shown.
- The type, location, depth, numbers and length of cables, cable ducts or pipes. A cross section of the pipe arrangement shall be shown indicating pipe occupancy and spare ducts or pipes.
- The different types of cable route to be clearly shown, i.e. Type 1, Type 2, etc.
- Cable pits and cable turning chambers.
- Underline and under-road crossings.
- The arrangement of cable routes through creeks or waterways.
- The arrangement of cable routes on embankments, viaducts, gantries, railway bridges, etc.
- The location and identification of all relay rooms, equipment cases and trackside Signalling and telecommunications equipment.
- The location of cable heads and cable termination points.
- The location of cable joints.
- The location of telecommunications cable loading coils and repeater units.
- The location of cable route markers.
- The location and type, including the conductor sizes and number of cores, of all Signalling and telecommunications cables (main and local).
- The location and type of all power supply cables including 2kV, 11kV, etc.
- Aerial cable routes, where applicable. The location and identification number of all poles or structures on Sydney Trains land are to be shown.
- The location of air lines, manifolds, compressors, etc.

The As-Built drawings to be supplied include DSS drawings for the total work. As built DSS drawings shall include a schedule with full details of the cable installation and nominate the function of each cable plus the Cable Supplier's Drum Number.

4.3 Construction Photography – General Requirements

The Commissioning Engineer arranges for appropriate initial and ongoing digital photography of the site. Photographs are progressively collated, stored on appropriate media and inserted into the relevant work package. Separate folders shall describe the purpose and location of the subject. Photography shall include:

- Condition of the site prior to the commencement of work, fencing, drainage and existing infrastructure.
- All work subject to inspection and testing.
- Prior to being covered up including foundations and trenches.
- General progress and good workmanship.

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- Completed work.
- Incidents.
- Minor defects agreed at Practical Completion and the rectification work.

Where appropriate a document shall be created to describe the location, apparatus, purpose, situation and reasoning intended to be conveyed in the photographs.

5 Commissioning Documentation

5.1 Commissioning Notice

The Commissioning Engineer shall be responsible for the production of the Commissioning Notice.

The Commissioning Notice forms part of the Commissioning Work Package that is defined in this document.

Commissioning Notices are for the use of all employees engaged in or associated with the commissioning.

Details shown in the notice shall include the following sections:

- 1. Scope of the commissioning**
 - Times, limits, description of work in accordance with Weekly Notice No.
- 2. Track possession details**
 - Possession notes, Safe Notice No.
- 3. Isolations details**
 - Power off permit - details and arrangements.
- 4. Commissioning headquarters**
 - Location, telephone numbers, names and contacts details of Commissioning and Deputy Commissioning Engineers.
- 5. Accreditation and competency statement**
 - Personnel to carry out duties only within the bounds of their license.
- 6. Reporting for duty**
 - Start and finish location/s.
 - All personnel must sign on and off duty.
- 7. Team Leader instructions**
 - Issue, use and signing of work instructions.
 - Advising HQ of whereabouts.
 - Work to commence only as directed by Commissioning Engineer.
 - Issue and control/use of radios.
 - Responsibilities of leaders associated with conduct of work by team members.
 - Reporting progress of activities as stated on the work instruction.
 - Reporting of problems and delays as stated on the work instruction.
 - Return and certification of work instructions.

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8. Instructions for team members

- Assembly areas.
- Proceed under direction of Team Leader.
- Team Leader to provide working instructions.

9. Reporting instructions for personnel unable to attend as arranged

10. Testing and Certification

- Instructions for personnel conducting aspect testing, proceed directions, reporting arrival at a signal, communications protocols for aspect testing - describing physical location, signal profile, order of descriptions, signs and nameplates and trainstop position.
- Instructions for rail vehicle detection system (track circuit and axle counter) teams, reporting when each track section is certified, communications arrangements for correspondence testing to design engineer at panel.
- Instructions for Control Systems teams, reporting when each Control System asset is certified, communications arrangements for correspondence testing to Control Systems Test Engineer at the panel.
- Point's correspondence testing, standard method of orientation and description of point switch position, communication protocols for correspondence of points to the panel.

11. Communications facilities

- Description of the various communications available, radio channel usage, telephones and numbers available at specific locations (e.g. maintenance telephones in locations), Commissioning HQ and emergency numbers.

12. Pre-Commissioning Meeting

- Details of required attendee's, location and time of pre-commissioning meeting.

13. Post-Commissioning Meeting

- Details of persons attending location, date and time of pre-commissioning meeting. Details of method of submission of comments for consideration at the meeting. Minutes of meeting to be sent to people who submit comments.

14. Work Health and Safety

- Site induction requirements.
- Wearing of protective clothing and high visibility vests.
- Consequences of non-compliance.
- Location of first - aid boxes and personnel.
- Alcohol, drugs and random testing notification.
- Personnel to act on directions of hand signallers/protection officers where provided.
- Personnel to be prepared for inclement weather by being in possession of approved wet weather gear.
- Notification of incidents and injuries.
- Addresses and or telephone numbers for ambulance, local medical centres and hospitals.

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15. Environmental

- List environmental risks and preventative measures in place.
- Outline mitigating responses required in case of an incident.
- Detail any equipment provided, location and persons available to respond.
- Detail notification requirements to the Rail Management Centre for their advice to the Sydney Trains environmental Response Leader.

16. Vehicles and Equipment

- Listings of minimum requirements expected that personnel bring to site (as applicable), vehicles, hand tools, meters, wet weather gear, torch and battery, hand signalling equipment, special testing equipment.

17. Meals and Facilities

- Locations of toilets and meal rooms, details of what will be provided (if any).

Copies of approved Commissioning Notices shall be issued prior to the Pre-Commissioning Meeting for Team Leaders and a copy e-mailed to ICON.

Sufficient copies shall be issued to provide one copy for each Team Leader/person involved in or with the commissioning who needs to know.

5.2 Advertising of the Works – Weekly Notice

The Commissioning Engineer shall liaise with the Regional Signal Representative to ensure that full detail of all alterations is advertised with at least one week's notice in the Weekly Notice. Details shall include any new and altered work or alteration that results in a change to any physical or operational interface with signallers or train drivers.

Notify the design office with sufficient time for the preparation of the Weekly Notice insertion. This shall be provided to the design office a minimum of nine (9) weeks prior to the date of commissioning except as otherwise agreed.

The advertising arrangements shall meet the requirements of the Infrastructure Engineering Specifications, Procedures and the Network Procedures.

6 Equipment Registers

6.1 Responsibility

Maintenance of the Sydney Trains equipment register is the responsibility of the Regional asset manager/engineer who shall populate and update details of changes due to new and altered works.

6.2 Provision of Information by the Commissioning Engineer

Spreadsheets nominating new equipment commissioned shall be provided by the Commissioning Engineer when specifically nominated and agreed in the Project Work Notification. The Regional Signal Representative and/or respective Control Systems Asset Engineer shall provide the required spreadsheet nominating all required fields at the time of agreement.

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7 Works and Inspection, Testing & Commissioning Programs

7.1 Summary and Detailed Works Programs

The Commissioning Engineer shall prepare a Summary Works Program to be approved as part of the Project Work Notification. The Commissioning Engineer shall prepare; implement, monitor and update a Detailed Works Program/s for the implementation (construction and commissioning).

Sub-sections of the program shall be produced for the Inspection and Testing and Signalling Safeworking requirements including stage work, temporary work, worksite protection and possession activities. The Commissioning Engineer may delegate these tasks to other competent resources as required.

Milestones, submissions, review hold points shall be incorporated into the program including:

- Design reviews.
- Delivery of long lead items.
- Completion of the works to allow submissions of construction and testing masters to design 4 weeks prior to programmed commencement of testing or commissioning respectively.
- As identified in the quality assurance strategy for the works.
- Notification of Weekly Notice requirements to Regional representative 9 weeks from commissioning.
- Agreed track possessions.

7.2 Program for Signalling Safeworking, Inspection, Testing and Commissioning

The Commissioning engineer shall prepare a Signalling Safeworking, Inspection, Testing, and Commissioning Program as part of the Inspection and Testing Plan and as a detailed sub-section of the Works Program.

The inspection, testing, and commissioning program shall be developed and detailed in successive issues of the Inspection and Testing Plan.

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8 Inspection and Testing Plan

8.1 General

Installation inspections and tests, reviews, processes and approvals for the signalling works shall be included in the Quality Assurance Strategy for the works. The particular requirements shall be extracted during a review of the applicable construction Specifications, Project Work Notification, Interface Coordination Plan and the scope of works. These requirements shall be extracted and documented in the strategy for Quality Assurance section of the plan and expanded in the outline and detailed plans. The listing shall nominate the requirements for the notification, witness and hold points applicable. Further, the plan may include agreed Engineering, Regional Signal Representative, Control Systems Operations, Operational Technology, sub-contractor and third party notification, witness and hold points.

Interfaces between new and altered work and the existing Signalling systems require careful planning from the concept stage of the project. The design, program, work practices, checking, inspection and testing shall be arranged to ensure that the interface solution minimises work in and around existing Signalling apparatus thus minimising access and risks affecting reliability, accidental damage, security and interference. Refer to *PR S 47116 Inspection and Testing of Signalling: Interface Requirements and Procedures for Alterations*, for further requirements.

The determination of whether any particular signalling work is ‘Minor’ or ‘Major’ will be documented in the Interface Coordination Plan between the Commissioning Engineer and the Regional Signal Representative.

Where Signals and Control Systems works are both required for the project, the Commissioning Engineers from each discipline shall determine the package hierarchy and structure. This includes whether there shall be one package or separate packages for Signals and Control Systems and how these will be coordinated. This coordination will be defined in the Inspection and Testing Strategy.

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8.2 Inspection and Testing Process Flow

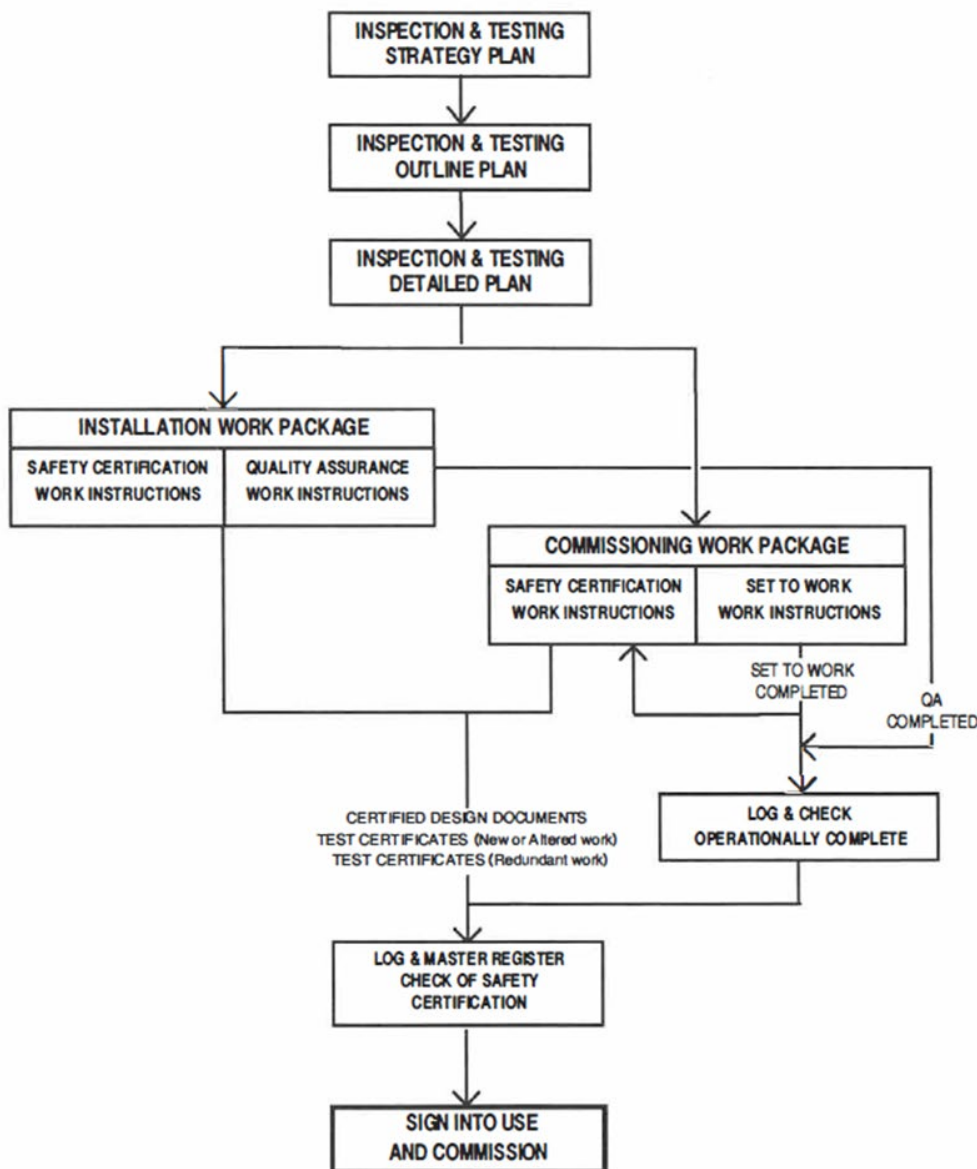


Figure 3: Inspection and Process Testing Flow

8.3 Notification of Inspections and Tests

When the Project Engineer is not the Commissioning Engineer, the Commissioning Engineer shall approve the fully prepared Inspection and Testing Plan, Inspection and Testing and Commissioning Program/s, attend program reviews and monitor/review audits of site activities.

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8.4 Commissioning Engineer's Review of Inspection and Testing Plan

When the Project Engineer is not the Commissioning Engineer, the Project Engineer shall submit each of the three stages (Strategy, Outline, Detail) of the Inspection and Testing Plan for review to the Commissioning Engineer. The submission dates shall be agreed and nominated in the Works Program.

Any subsequent changes to the Inspection and Testing Plan are to be submitted to the Commissioning Engineer for review and approval 14 calendar days before the changes are planned to occur.

All possible pre-commissioning inspection and testing activities shall be so arranged as to be completed a minimum of 14 calendar days prior to the planned start of the commissioning.

8.5 Preparation of the Inspection and Testing Plan

An Inspection and Testing Plan shall be prepared for all new and altered Minor or Major Signalling Work. For details of the requirements for Minor Signalling Work, refer to Section 11.

The Inspection and Testing Plan shall be formulated and prepared by the Commissioning Engineer in staged parts in accordance with the format below and utilising forms from *SPG 0711.7 Standard Forms*. If work incorporates both Signals and Control Systems changes then the Signals Commissioning Engineer shall be responsible for the Inspection and Testing Plan. The Control Systems Commissioning Engineer shall be responsible for formulating and preparing the Control Systems Inspection and Testing Plans in accordance with the format below and utilising forms from *PR S 47117 Inspection and Testing of Signalling: Standard Forms*. The completed Control System Inspection and Testing documentation shall be issued to the Signals Commissioning Engineer for consolidation and completion of the final Inspection and Testing documentation.

When the Project Engineer is not the Commissioning Engineer the Inspection and Testing Plans shall be approved by the Signals Commissioning Engineer.

For new equipment and systems or where the inspection and testing tasks and/or pass/fail criteria are not nominated or where conflicting requirements may be interpreted from the Standards, Specifications, Manuals, Guidelines or Instructions the actual requirements shall be determined by the Professional Head Signalling and Control Systems.

For Computer Based Interlocking system requirements refer to *Specification SPG 0719 Computer Based Interlocking*, and the manufacturer's recommendations.

The end requirement of the process is to produce work instructions that are comprehensive and specific to the actual requirements. *PR S 47117 Inspection and Testing of Signalling: Standard Forms*, contains checklists for typical inspection and tests (I.T.F's) that are provided as a guide to Signals and Control Systems typical requirements. Where a database is used to assist in the production of typical documentation, the Commissioning Engineer shall be responsible to review, update, tailor and add any new or modified activities/tasks required to comply with the Sydney Trains Infrastructure Engineering Specifications - Signalling, the actual systems, equipment, interfaces and stage work.

8.6 Identification

- Project Description
- Register Number
- Version number and date.

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8.7 Parts

The Inspection and Testing Plan is prepared in three staged parts that require review by the Commissioning Engineer:

Part 1 Inspection and Testing Strategy

Part 2 Inspection and Testing Outline Plan(s)

Part 3 Inspection and Testing Detailed Plan(s).

8.8 Inspection and Testing Strategy

The Inspection and Testing Strategy is a written general description of the approach to the inspection and testing, Signalling Safeworking, associated worksite protection and possession requirements for the construction and commissioning of new and altered works. Further, it is a general description of the scope of works, methodology and resources required for significant aspects and as applicable cover the following sections.

- Implementation strategy for the works, e.g. on and off site work, and operational restrictions and requirements; identify all third party and internal interface work to be coordinated and power on dates for new supplies and temporary power requirements.
- Strategy for inspection and testing for safety certification and quality assurance aligned with the implementation strategy for the works.
- Strategy for quality assurance.
 - Identification of inspection and testing during the construction phase to include the inspections, tests and certification of compliance required by the Construction Specifications and set the hold points required, e.g. services searches, circuit correlation checking and testing, cable routes, U.L.X's, cables, structures, foundations, formwork, earth mats, off-site work, desk and rack construction and fit-out, structure cables, and comms links.
- Identification of inspection and testing requirements for interface and stage work.
- Scope, methodologies and access limitations for inspection and testing of interface work and testing systems with minimal impact to Operations.
- Scope, methodologies and responsibilities at Commissioning, including Locking, Design Integrity and Site Acceptance Testing requirements.
- Practices to be used to confirm the condition of any existing systems to be modified e.g. provisions of the Interface coordination plan, design correlation check.
- Provisions for signalling safeworking, relocating or removing existing signalling.
- Provisions for ensuring that no ambiguity exists as to the signalling system in force during installation testing and commissioning e.g. testing during traffic, installation maintenance removal of "X" boards on signals, Weekly Notices and blue outline on partial commissioned Control Systems equipment, non-commissioned cables, servers, etc.
- Possession and Worksite Protection requirements for inspection and testing.
- Inspection and testing personnel requirements.
- Organisation Chart for the inspection and testing program.
- Access requirements and restrictions.
 - List of any special access requirements to the Sydney Trains site for conducting inspections and tests.

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- Co-ordination with other works e.g. Track, Civil, Electrical (Power & OHW), Condition Monitoring and Operational Technology.
 - Procedure for identifying other works, liaison with responsible parties, and identification of responsibilities for the coordination activities.
- Test equipment, site communication requirements.
 - List of test equipment and communication facility requirements for each part of the inspection and testing program including test instruments, specialist tools, test trains, portable radios. Shared use of these facilities between groups.
- Training and accreditation requirements for inspection and testing personnel.
- Special considerations.
- Schedule of reviews and approvals required such as:
 - Documentation reviews
 - Inspection and testing personnel review
 - Possession approvals
 - Access approvals
 - Equipment and/or system type approvals
 - Engineering concessions and deviations required
 - Environmental hazards and management of their risk
 - Occupational Health and Safety issues.
- The Inspection and Testing Strategy Matrix checklist form included in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*, is the strategy checklist that is used to assist with the development of the outline then detail plan/s for the inspection and testing activities. Using the project scope and design identify (listed or new) systems/apparatus in the left hand column, reading across place a “X” in the columns that identify the required inspection and testing activities for the certification of the new and altered works. The marked activities are included in the Inspection and Testing Outline Plan.

8.9 Inspection and Testing Outline Plan

Inspection and Testing Outline Plans for each phase/stage of the works shall be presented in the form of a table. A sample format is included in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*.

Each Inspection and Testing Outline Plan should provide an overview of the individual activities to be performed on the particular systems and apparatus that constitute the works. The activities include those identified in the inspection and testing strategy and are used to plan the sequencing and the general resources certifying them as outlined in the following sections.

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8.9.1 Activity

Inspection and testing activities nominally fall into the following categories:

- Design control
- A joint site inspection for the documentation of the site integrity agreement portion of the interface coordination plan
- Acceptance inspection and testing of manufactured equipment including type approvals
- Quality and construction inspections
- General apparatus inspections
- Cable testing
- Circuit testing
- Set to work, test and certify
- Apparatus function testing
- System function testing
- Null Count prior to Booking into use.

These are broken down into stand-alone units of work that are applicable to individual systems or apparatus.

8.9.2 Systems/Apparatus

These are the system elements identified in the Inspection and Testing Strategy described in more detail.

At this stage it is not necessary to identify each individual element, but rather the types and quantities of each element.

8.9.3 Certified By

Describes the licensing requirements of the person who will certify the completion of an activity.

8.9.4 Certification Documents

Describes the actual documents required for the recording of the certification of each activity.

8.9.5 Standards and Procedures

Nominates the particular reference standards/documents describing the performance requirements of the activity.

8.9.6 Time

Describes the approximate start time and duration planned for an activity and is used to develop the inspection and testing program.

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8.10 Inspection and Testing Detailed Plan

The Inspection and Testing Detailed Plan is based on the Outline Plan and expands the detail to include the inspection and testing and signalling safeworking activities necessary during each phase/stage for each specific unit of Signalling apparatus/system. Additionally, the worksite protection requirements for the works shall be planned and programmed. The installation and/or commissioning work package will include the detailed work instructions as analysed and nominated by this process.

Signalling Safeworking, activities for signalling apparatus include:

- Signalling Safeworking Procedures e.g. Bridging Authorities, Damage to Signalling Equipment, Booking Out and Disconnection of Signalling Apparatus, Testing of Interlockings, Track Circuits, Axle Counters, Rerailing, Traction Return, FPL and Detection testing, Security locking and keys, Deviations/Concessions, Control Systems, Signalling related risk assessments – Electrical, Mechanical and Pneumatic etc.
- The installation, maintenance and removal of retro-reflective cross boards on signals and any specific requirements to assist testing (where unavoidable) during traffic.
- Alteration, Relocation and Removal of Signalling apparatus, telephones, circuits, cables, track bonding, earthing, airlines, power supplies, mechanical Signalling apparatus or Safeworking systems.
- Location and equipment checking (final power supply voltages, terminations, status check and security).
- Certification of Signal Sighting Checklist & Forms. The installation of signals shall be certified to comply with the agreed Signal Sighting Checklist & Forms. At commissioning an experienced field Signal engineer shall certify that the provisions of the form have been met during construction, set to work and focus, also that potential read through conflicts have been minimised during the progress of trains approaching the signal. Progressive certification shall be included in the Inspection and Testing Plan, installation and commissioning work packages for the works.
- Booking “into use”.

Compile lists of individual elements and apparatus/systems identified in the Outline Plan, e.g. lists of locations, relay rooms, cable routes, points, signals, track circuits, axle counters, trainstops, interfaces, telemetry systems, control systems, telecommunications systems and apparatus/systems. Further, compile lists of all apparatus that will become redundant. For each item - analyse the inspection, testing and Signalling Safeworking, activities required and document using the form included in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*.

- Description of inspection and testing and Signalling Safeworking activities as nominated in the Infrastructure Engineering Specifications – Signalling Construction, the Inspection and Testing of Signalling Specifications and Technical Manual, *MN S 40000 Signalling Safeworking Procedures*.

For each area or stand-alone unit of apparatus or system: e.g. Alteration – relocation or removals, apparatus inspection, cable, circuit testing, set to work, test and certify, null count, apparatus and system function testing.

- Determine when the activity will take place and its duration; incorporate this information into the detailed Works Program.
- Determine requirements to resource the activity; incorporate this information into the detailed Works Program.

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- Determine any special requirements, e.g. approvals, training, tools or test equipment.
- Work packages where the inspection and testing documentation is to be managed :
 - Installation Work Package No
 - Commissioning Work Package No
 - Minor Work Package No.
- Transfer the required work instructions to the nominated package, allocate a work instruction number and list the number in the package reference column.

9 Procedures for Installation, Commissioning and Handover Documentation Work Packages

9.1 Documentation Structure

The Commissioning Engineer shall manage the certification inspection and testing of the total scope of the works by the use of a structured set of documentation work packages as described hereinafter. Where multiple disciplines are involved the Signals Commissioning Engineer will issue Work Instructions as required for the completion of Control Systems activities. *PR S 47117 Inspection and Testing of Signalling: Standard Forms*, contains samples of the nominated forms.

The work packages shall consist of the following and shall be available at any time for safety and quality surveillance and audit.

The following work packages are required:

- Inspection and Testing Plan
- Installation Work Package
- Commissioning Work Package
- Handover Documentation Package.

For Minor Signalling Work that complies with the definition in PR S 47110 and agreed with the Regional Signal Representative:

- Minor Work Package (Section 11)

Each work package shall be registered with a discrete Work Package Number provided by the Commissioning Engineer and shall be the same Project Description as provided for the Inspection and Testing Plan.

If content of any section of a package is determined to be “not applicable” a statement detailing the reason is to be provided in its place.

After the Commissioning Engineer has prepared and reviewed each work package it shall be submitted for review and approval in principle by the Regional Signal Representative.

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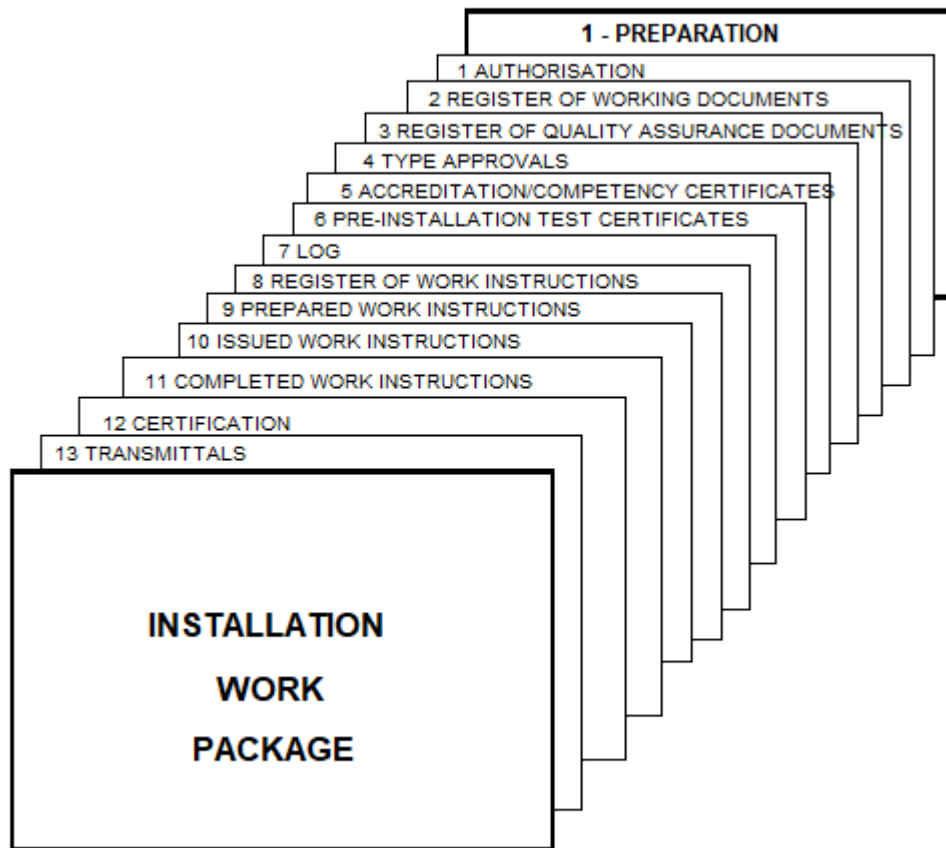


Figure 4: Installation Work Package Structure

9.2 Installation Work Packages Structure

9.2.1 Purpose

The purpose of this procedure is to provide directions for the preparation of the Installation Work Package.

9.2.2 Scope

The Works Program, sub-section, Inspection and Testing Plan, and quality control procedures determine the requirements to be incorporated into the Installation Work Package.

Prepare work instructions to implement the installation inspection and testing, Signalling Safeworking, checklists, certificates and other records to provide the necessary quality control and safety assurance as required by the Sydney Trains Engineering Specifications - Signalling.

The Installation Work Package shall contain all safety and quality assurance records for Signalling items manufactured for subsequent installation at site. The originals of Test Certificates, provided by equipment manufacturers or suppliers shall be obtained for insertion in the Installation Work Package by the Project Manager, Site Manager and/or Commissioning Engineer prior to the installation of the respective equipment. Copies of Test Certificates are to be provided with the equipment when sourced from internal stores.

Requirements and structure for the Installation Work Package are illustrated in Figure 4 Installation Work Package Structure. The referenced forms are found in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*.

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This procedure covers the steps to be taken following the completion of the Work Program and Inspection and Testing Plan for the development and implementation of the Installation Work Package for the implementation phase.

9.2.3 Applicability

It is a requirement that an Installation Work Package as described in this procedure is prepared for new and altered signalling works.

Exception: Works that comply with the definition of Minor Signalling Work may be documented as set out in Section 11 of this document.

9.2.4 Responsibility

9.2.4.1 Management, Engineering and Construction Personnel

For Project Manager, Regional Signal Representative, Commissioning Engineer, Team Managers, Site Managers and Work Group Leaders - refer to *PR S 47111 Inspection and Testing of Signalling: Roles, Responsibilities and Authorities*.

9.2.4.2 Team Leaders

Responsible for performing the work to the Sydney Trains standards, manuals and instructions and as delegated by the Commissioning Engineer, Site Manager and Work Group Leaders. Managing the work team/s, and completing the work included on the Installation Work Instructions, signing and returning Work Instructions.

Report to the Site Manager/Work Group Leader all defects, defective material, incidents and items requiring further action related to the performance of the installation, inspection, testing and commissioning of the works.

9.2.5 Associated procedures

- Preparation of Commissioning Work Package
- Implementation of Commissioning Work Package
- Evaluation of Commissioning Work Package.

9.2.6 Procedure for Preparation of Installation Work Package

9.2.6.1 Authorisation of Package

9.2.6.2 Register of Working Documents

Complete the register of construction copies of working drawings and update progressively as soon as information becomes available, showing the current version with earlier versions clearly designated as “SUPERSEDED” in the Register, and include items listed in the following sections.

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9.2.6.2.1 Construction Copies of Working Drawings and Documentation

Including:

- Circuit Book
- Signalling/Track/Balise Plan
- Track Insulation/Bonding Plan
- ETCS Tables (refer to PR S 45009)
- ETCS L1 LS Exported Test Cases (refer to PR S 47120 and PR S 45006)
- ETCS L1LS and ASDO Data Release Note (refer to PR S 45006)
- Control Systems Release document
- Data Build
- Configuration Scripts
- Working Sketch
- Locking Table
- Locking Diagram
- Signal Sighting Checklist & Forms
- Site Installation Drawings
- Mechanical
- Level Crossing Layout
- Structure and Building
- Clearance Diagram (historical)
- Equipment Layout
- Equipment Design
- Modifications
- Sign off that all "as built" drawings are included in the Handover Documentation Package.

9.2.6.2.2 Register of Detailed Site Survey Plans

9.2.6.2.3 Register of Equipment and Operating Manuals

Including:

- SOE Documentation
- Computer Build Procedures
- Computer Configuration Procedures
- SCADA Manual.

9.2.6.2.4 Register of Test Copies of Working Drawings

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9.2.6.3 Register of Quality Assurance Documentation

Quality Assurance documentation covers inspection and testing activities that are not included as part of the safety certification records.

- Site inspection reports (Quality) e.g. references Detailed Site Survey, Signalling Construction Specifications, etc.
 - Acceptance of manufactured and/or installed equipment.
 - Manufacturer's inspection and testing certificates.
 - Offsite inspection and testing certificates e.g. Pre-site Test Certificate.
 - Onsite inspection and testing certificates.
 - Ready for Test Certificates.

9.2.6.4 Type Approvals Specific for Project

Including:

- All project specific approvals from the Professional Head Signalling and Control Systems.
- Any deviations granted by the Professional Head Signalling and Control Systems.
- Any Concessions granted by TfNSW Asset Management Branch.

9.2.6.5 Accreditation/Competency Certificates

9.2.6.6 Pre- Installation Acceptance of Equipment and Software

- Inspection and testing certificates involving bell continuity testing or wire counting, null counting, not repeated after installation.
- Inspection and testing certificates involving function or system testing not repeated after installation.

9.2.6.7 Installation Log and Site Photography

9.2.6.8 Register of Installation Work Instructions

9.2.6.9 Prepared Installation of Work Instructions

9.2.6.10 Issued Installation Work Instructions

9.2.6.11 Completed Installation Work Instructions

9.2.6.12 Certification of Installation Work Package

The Installation Work Package is signed off 2 weeks before the commissioning to enable authorisation of the Commissioning Work Package. Incomplete activities are transferred to Pre-Commissioning Work Instructions in the Commissioning Work Package. Installation Status Certificates are completed and signed off.

This also includes variations to the Inspection and Testing Plan and approved deviations and concessions to Standards.

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9.2.6.13 Transmittals

Copies of Document Transmittal Forms for transmittals of all documents related to the Installation Work Package are inserted in the Section 13 of the Installation Work Package.

9.2.7 Procedure for the implementation of the Installation Work Package

9.2.7.1 General

Implement and update the plan to reflect progress of the work and any changes.

9.2.7.2 Installation Log

A Log shall be used to formally record any queries, discrepancies or deficiencies arising during the construction of the installation, quality of the work, incidents, quality and inspection and testing of the works. The Log shall also include all activities, tasks and events not covered by work instruction. The Log shall provide a traceable record to detail to resolution usually minor issues. Where the resolution of the issue requires inspection and testing or detailed activities or tasks to be undertaken, a work instruction shall be created and registered. The Log shall be updated to include the number of the particular work instruction created to action the issue. Traceability shall be possible for all matters included in the Log.

Each item shall be given a separate item number when entered on the Log. See *PR S 47117 Inspection and Testing of Signalling: Standard Forms*, for the required form.

The Site Manager, Test Engineer, or Commissioning Engineer shall initially fill in the Log detailing the problem being reported. The symptoms shall be clearly identified and where necessary, shall give guidance to the person from whom the response is required. The Commissioning Engineer shall conduct regular reviews to ensure satisfactory resolution of reports and where necessary update the log to nominate the required action to achieve a resolution. Persons providing reports shall be advised of the progress of actions.

9.3 Progress Reporting of Inspection and Testing

The progress of inspection and testing shall be closely monitored, weekly program and progress reviews shall be conducted, analysed and remedies implemented as required.

Where the program implementation and monitoring is delegated to the Site Manager and or Team Leader reports on the status of each of the planned inspection and testing activity shall be provided weekly to the Commissioning Engineer.

9.4 Reporting Defects and Irregularities Found

All defects found during or after installation and certification inspection and testing by site personnel and Test Engineers should be promptly reported to the Commissioning Engineer. After which they should promptly investigate and establish the cause of the defect and submit the proposed action to rectify the defect to the Commissioning Engineer for review and permission to proceed.

The nature of the defect shall be considered in relation to the extent of sub-standard work it could be representative of and consequently the depth and breadth of investigative and corrective action required.

Use standard Inspection and Test Form ITF 12 in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*, for obtaining the permission of the Commissioning engineer.

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Similarly should function tests, or other later events, reveal errors in the physical installation that earlier had been certified as correct, then this shall be immediately reported to the Commissioning Engineer, recorded in detail, and fully investigated and corrective action taken to the satisfaction of the Commissioning Engineer.

Any signalling irregularities found during or after commissioning should be managed in accordance with PR S 40004.

9.5 Installation Inspection and Testing Status Certificate

An Installation Inspection and Testing Status Certificate (see *PR S 47117 Inspection and Testing of Signalling: Standard Forms*) shall be completed to certify that all planned certification inspections and tests to be carried out during the installation stage are properly completed or transferred to the Commissioning Work Package. Acceptance of the Installation Inspection and Testing Status Certificate by the Commissioning Engineer will be a prerequisite to commencement of review and approval of the Commissioning Work Package. The Status Certificate shall document the transfer of all uncompleted Installation Work Instructions and uncompleted actions from the Installation Inspection and Testing Log and list any approved variations to the Inspection and Testing Plan or deviations and concessions to standards or procedures.

9.6 Commissioning the Works

9.6.1 General Requirements

The Commissioning Engineer shall prepare plans, programs, and work packages for the commissioning of the Works. The Commissioning Engineer shall coordinate, direct and control the implementation of the Commissioning Period of the Works.

The plans and programs for commissioning of the Works or any part thereof shall provide for all work to be carried out in compliance with Sydney Trains possession requirements and the Network Rules and Procedures.

These plans and programs shall include rosters and Work Instructions for all persons engaged in the Commissioning. Rosters shall take into account the requirements of the Sydney Trains fatigue management system. Rosters and procedures shall comply with all relevant Work Health and Safety legislation and regulations applying in New South Wales.

The plans and programs for the Commissioning shall allow adequate time and resources to complete the work and shall include risk minimisation strategies and contingencies for any undesirable eventualities that can reasonably be anticipated within the allocated possession time. Eventualities that can be reasonably anticipated include inclement weather, additional and delays to rail traffic through the possession area, delays in obtaining overhead power isolation and 'Permit to Work', plant breakdown, equipment failure and damage, fault rectification required in previously untested work, commissioning design modifications and availability of personnel.

9.6.2 Operational Requirements

It is desirable that all field activities associated with the de-commissioning, changing-over and testing work and Commissioning, be carried out when rail traffic is excluded (track possession). If train running is unavoidable, any testing that involves unlocking of points; the risk of displaying to train drivers inappropriate signal indications; affects reliability or disrupt train running shall be carefully planned and completed in the time available. Safe working of trains shall be in accordance with the Network Rules and Procedures and conducted by appropriately accredited personnel. All hazards during testing and commissioning shall be identified and appropriate contingency plans shall be put in place.

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There shall be a clear understanding and agreement between all involved parties of the safe working systems to be employed during the period from the shutdown of the old system to the commissioning of the new system.

9.6.3 Testing and Certification

All inspection, testing and certification carried out during the commissioning shall be recorded and the records shall be available for audit at any stage of the commissioning.

9.6.4 Interfaces

At interfaces, after connection and integration of the new work with the old, certification through tests of each complete circuit and equipment function shall be carried out.

9.6.5 Design Modifications

If any design modifications are found to be necessary during the Commissioning, the requirements of Specification *SPG 0703, Signalling Documentation and Drawings*, shall be strictly applied, using the Modification Instruction Forms.

9.6.6 Commissioning Certificate

When satisfied that all required commissioning, inspection, testing and certification is complete, all redundant equipment has been decommissioned and made safe, the Works, or the relevant part thereof, are fit for purpose and ready for use, and meet all rail safety requirements, the Commissioning Engineer shall complete and sign the Commissioning Certificate then proceed to book into use the new and altered works in accordance with the provisions of the Network Rules and Procedures.

9.6.7 Decommissioning and Disposal

De-commissioning and disposal shall be planned as part of the testing and commissioning activities, and safe and efficient disposal shall be a condition of the final completion of the project.

It shall be responsibility of the Commissioning Engineer to:

- Establish the impact of decommissioning and disposal on any system or external facility associated with the system to be de-commissioned.
- Plan the decommissioning, including the establishment of procedures for:
 - The identification and removal of all de-commissioned and redundant equipment.
 - The safe shut down of the system and any associated external facility.
 - The safe dismantling of the system and any associated external facility.
 - The assurance of continued functioning and safety integrity of any systems or external facility affected by the decommissioning of the system.

All redundant materials, structures and equipment including wire and cable shall be removed during the commissioning wherever such equipment may impinge on the operation of the new work or could lead to confusion or distraction of train drivers, operators or maintainers. Annett keys and locks, “Fortress” keys (on ESML or EOL systems) and locks shall be handed to the Commissioning Engineer and a receipt obtained.

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9.6.8 Requirements for Commissioning to Proceed

The commissioning of the Works or any part thereof shall not proceed unless:

- Preparation is complete, including nominated notifications, witness and hold points.
- Applicable spares, tools, test equipment are available on site or at an agreed location.
- Any applicable training courses for operations and maintenance personnel have been completed.

9.6.9 Requirements immediately following Commissioning

Applicable circuit diagrams, Track Circuit/Wheel Sensor/Point History Cards, plans, drawings, manuals and handbooks and Control systems Data Build, Release Record and Circuit Book are to be provided to the Regional Signal Representative and/or respective Control Systems Maintenance Engineer for distribution to maintenance personnel. Where any modification has been necessary during the commissioning, these changes shall be marked up and identified by the applicable Modification Form number.

9.7 Test Equipment

All instruments and apparatus used in inspections and tests shall be calibrated to the extent required to provide consistent measurement and the degree of accuracy required by the inspection or test for which they are used. Calibration, where necessary, shall be carried out by a recognised authority and records of calibration shall be maintained and be available for audit at any time.

9.8 Commissioning Work Package

A Commissioning Work Package is required for the commissioning of the works, or each phase, section or stage of the works as identified in the Works Program.

The requirements, responsibilities and procedures for a Commissioning Work Package are described as follows in three sections. Samples of associated forms requiring sign-off are found in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*. The contents of the Commissioning Work Package are set out as follows:

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SECTION 1 – PREPARATION	REFERENCE
AUTHORISATION	1-1
SAFeworking FORMS & PERMITS	1-2
WEEKLY NOTICES AND CIRCULARS	1-3
SCOPE OF WORKS	1-4
COMMISSIONING PROGRAMME	1-5
COMMISSIONING NOTICES	1-6
PREPARED PRE-COMMISSIONING WORK INSTRUCTIONS	1-7
PREPARED COMMISSIONING WORK INSTRUCTIONS	1-8
PREPARED POST-COMMISSIONING WORK INSTRUCTIONS	1-9
MINUTES OF PRE – COMMISSIONING MEETING	1-10
SECTION 2 – IMPLEMENTATION	
REGISTER OF PRE-COMMISSIONING WORK INSTRUCTIONS	2-1
REGISTER OF COMMISSIONING WORK INSTRUCTIONS	2-2
REGISTER OF POST-COMMISSIONING WORK INSTRUCTIONS	2-3
COMPLETED PRE-COMMISSIONING WORK INSTRUCTIONS	2-4
COMPLETED COMMISSIONING WORK INSTRUCTIONS	2-5
COMPLETED POST-COMMISSIONING WORK INSTRUCTIONS	2-6
SECTION 3 – EVALUATION	
COMMISSIONING CERTIFICATE	3-1
COMMISSIONING LOG	3-2
ATTENDANCE BOOK	3-3
REPORT OF POST-COMMISSIONING MEETING.	3-4
TRANSMITTALS	3-5

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9.9 Commissioning Work Package – Phase 1 Preparation Before Commissioning

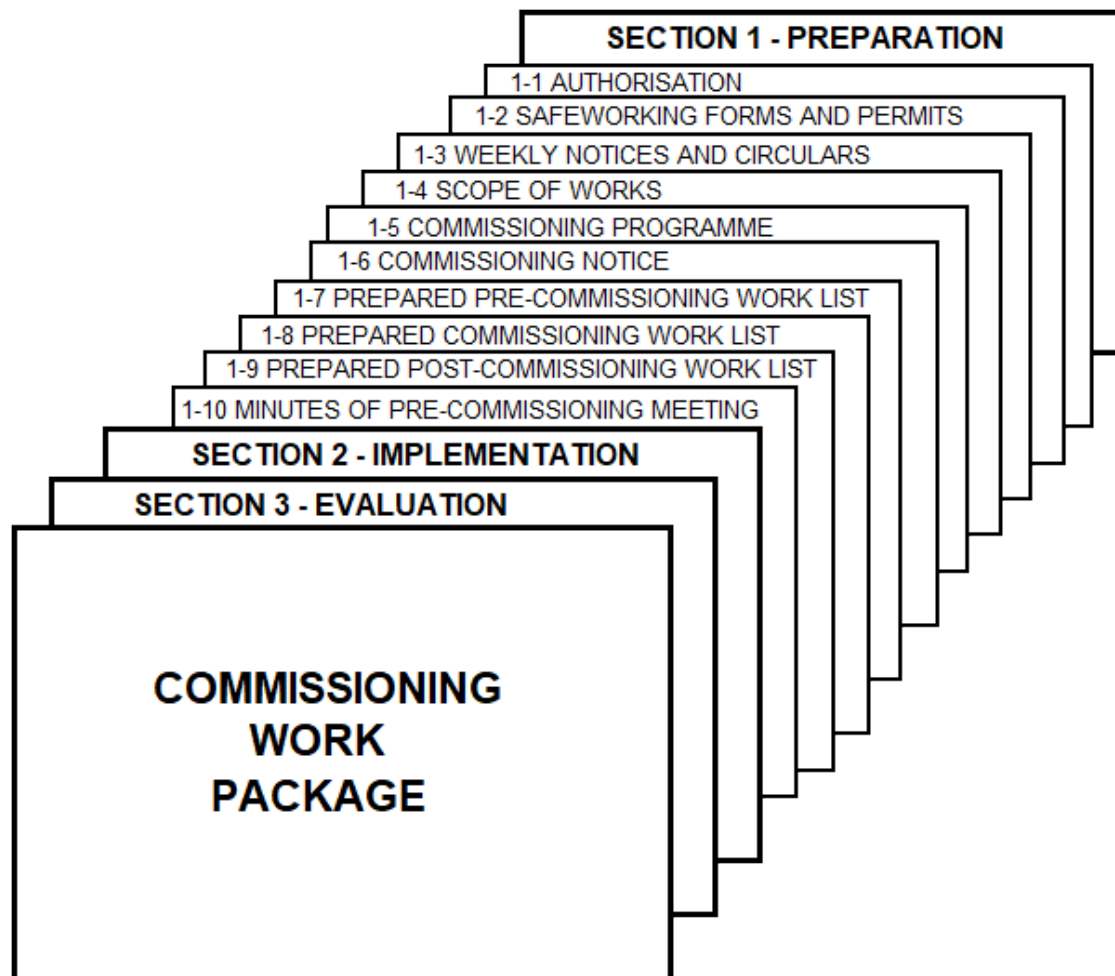


Figure 5: Commissioning Work Package Phase 1

9.9.1 Purpose

The purpose of this procedure is to provide directions for the preparation of the Commissioning Work Package.

9.9.2 Scope

This procedure covers the steps to be taken during Phase 1, the Preparation Phase for the Commissioning Work Package. This phase is called the Pre-Commissioning Period that starts with the preparation before commissioning and ends when the existing equipment is "booked out of use".

9.9.3 Applicability

It is a requirement that a Commissioning Work Package as described in this procedure is prepared for each commissioning.

Exception: Minor Signalling Work may be documented as set out in Section 11 of this Specification.

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9.9.4 Responsibility

9.9.4.1 Management, Engineering and Construction Personnel

For Project Manager, Regional Signal Representative, Commissioning Engineer, Team Managers, Site Managers and Work Group Leaders - refer to *PR S 47111 Inspection and Testing of Signalling: Roles, Responsibilities and Authorities*.

9.9.4.2 Deputy Commissioning Engineer/s

Assist the Commissioning Engineer in the preparation, implementation and evaluation of the Commissioning Work Package. Attend the Commissioning Work Package reviews and Pre-Commissioning conferences. Maintain familiarity with the site conditions, Scope of Works, Interfaces, Project Work Notification, Inspection and Testing Plan, Signalling Safeworking, Commissioning Works Program, Design Integrity testing, Staffing details, Operational and Special requirements.

9.9.4.3 Team Leaders

Responsible for implementing the works to the Sydney Trains Standards, Manuals and Instructions and for performing the work as delegated by the Instructions, completing, signing and returning Work Instructions to the Commissioning Headquarters.

Report to the Site Manager/Work Group Leader all defects, defective material, incidents and items requiring further action related to the performance of the installation, inspection, testing and commissioning of the works.

9.9.5 Associated Procedures

- Implementation of Commissioning Work Package
- Evaluation of Commissioning Work Package

9.9.6 Procedure for Preparation of Work Package

9.9.6.1 Track Possession and Works Co-ordination Conferences

The Regional Signal Representative identifies other engineering works to be progressed during the commissioning period. In consultation with the Commissioning Engineer analyses the risk associated with the proposed works to ensure that it is compatible with the commissioning. The Commissioning Engineer maintains liaison with the other personnel in charge of “Other Works” and ensures integration of the works and interfaces. The Inspection and Testing Plan and Commissioning Work Package shall be updated to include any associated construction, inspection, testing and Signalling Safeworking requirements associated with “Other Works”.

9.9.6.2 Pre-Commissioning Conference

The Commissioning Engineer arranges the Pre-Commissioning Conference and produces and issues the minutes of this meeting and inserts a copy of the minutes in the Commissioning Work Package in Section 1-10.

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9.9.6.3 Starting the Work Package

At the same time as the minutes of the Pre-Commissioning Conference are prepared, the preparation of the Commissioning Work Package document based on the Inspection and Testing Detailed Plan shall commence.

Each Commissioning Work Package is registered and maintained by the Project Manager. The Commissioning Work Package is also identified by the Project name, the stage of the project, and the commissioning dates.

9.9.6.4 Preparation of Weekly Notice Insert

The Commissioning Engineer initiates via the Regional Signal Representative for the Design Section to arrange the publication of the Weekly Notice and Drivers Diagram for the agreed dates. The Regional Signal Representative provides draft copies of the write up for the Weekly Notice and Drivers Diagram insert, and/or circular to the Commissioning Engineer for comment. Copies of the request and progressive issues of the documents are inserted in Section 1-3 of the Commissioning Work Package.

Weekly Notice Inserts are only required where there are new and/or altered indications, control and/or signalling arrangements that have an impact to drivers and/or operators.

9.9.6.5 Communications – Radio and Telephone Systems

The Commissioning Engineer analyses the requirements for communications systems – radio and telephone for the commissioning. Factors including area of coverage, number of channels, number of handsets, battery life and cycle time for battery charges, requirements for power supplies are determined and arranged. Primarily the systems shall be optimised for communications to and from the Commissioning HQ and the control centre for the design integrity testing phase. The system shall be pre-tested to ensure it meets requirements. The procurement set up and pre-testing of the required arrangements may be delegated to the Site Manager/Work Group Leader/s.

All applicable documentation is inserted into Section 1-6 of the Commissioning Work Package.

9.9.6.6 Scope of Works

The Commissioning Engineer documents the scope of works of the Commissioning. This is done by means of a list of activities, which is broken down into the three phases of the commissioning and covers all activities as follows:

- Pre-Commissioning period activities
- Commissioning period activities
- Post-Commissioning period activities.

Reference to the applicable activities from the Inspection and Testing Plan, Signalling Safeworking requirements and Design Integrity Test Plan are included in the Scope of Works.

Applicable Installation Work Package(s) are reviewed to identify any incomplete activities and includes these in the scope of works.

A list of Working Drawings that are applicable is also compiled. The list identifies each drawing by description, title, number and revision. Drawings include the following categories:

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- Circuit Book
- Signalling/Track/Balise Plan
- Track Insulation Plan
- ETCS Tables (refer to PR S 45009)
- ETCS L1 LS Exported Test Cases (refer to PR S 47120 and PR S 45006)
- ETCS L1 LS and ASDO Data Release Note (refer to PR S 45006)
- Control Systems ‘Release’ document
- Working Sketch
- Locking Table
- Locking Diagram
- Lever Nameplates
- Detailed Cable Plan
- Detailed Site Survey Drawing
- Signal Sighting Checklist & Forms
- CBI Documentation.

The scope of works shall include the required activities necessary to complete the verification of each working drawing prior to commissioning. Further, to enable the Commissioning Engineer to update and sign the Certified Office Copy in the Post Commissioning period working drawings issued with Commissioning Work Instructions to be marked up signed and certified as a record of inspection and testing, including verification of the Signalling Plan and Track Insulation Plan, and Signal Sighting Checklist & Forms following setting to work.

The list of activities is checked against the working drawings, the Commissioning Program, the Possession Program, the Inspection and Testing Plan, Signalling Safeworking requirements, Design Integrity Test Plan and the Installation Work Packages, and as a check of completeness, is reviewed with the Testing Engineer.

The list of activities and list of working drawings signed by the Commissioning Engineer are inserted into Section 1-4 of the Commissioning Work Package.

The Commissioning Engineer completes, checks, and signs the “Safeworking Forms and Permits”. If a “1500 Volt Overhead Wiring Permit to Work” is required, the Commissioning Engineer prepares the associated personnel register. The Commissioning Engineer provides these documents for insertion in Section 1-2. Activities associated with these documents are included in the scope of works.

The documentation of the scope of works is to be completed 6 weeks before the scheduled start date of the commissioning.

9.9.6.7 Management and Team Structure

The Commissioning Engineer determines the management and team structure.

This describes the organisational structure that will be put into place for the Commissioning and is documented in the form of an organisation chart. This chart and any explanatory notes are inserted in Section 1-6 of the Commissioning Work Package.

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9.9.6.8 Identification of Teams

The Commissioning Engineer identifies the commissioning teams that will be required.

The Commissioning Engineer nominates the level of licensing, authorisations or competencies required for Team Leaders and team members for each team.

The list of teams and requirements are inserted in Section 1-6 of the Commissioning Work Package.

9.9.6.9 Preparation of Commissioning Program

The Commissioning Engineer prepares the Commissioning Program. This activity includes:

- The Commissioning Scope of Works
- The Inspection and Testing Plan
- The Signalling Safeworking requirements
- The possession program
- Worksite Protection requirements
- Design Integrity Testing Program
- Control Systems Testing Program and requirements
- Operational Technology Testing Program
- “Other Works” Program
- Test engine availability.

The Commissioning is coordinated with the availability of rostered personnel within fatigue management guidelines. This program is inserted in Section 1-5 of the Commissioning Work Package.

9.9.6.10 Preparation of draft Commissioning Notice

The Commissioning Engineer prepares the draft Commissioning Notice in accordance with Clause 5.1. This notice is as complete as is possible at this stage. Certain details such as exact staffing will not be complete, as this is dependent on determination of the roster. The notice is inserted in Section 1-6 of the Commissioning Work Package.

9.9.6.11 Review of Commissioning Work Package

The Commissioning Engineer, Deputy Commissioning Engineer, Regional Signal Representative, and Test Engineer/s review the Commissioning Work Package. The objective of this review is to determine any changes that may be required in order to update, refine, complete, approve and approve in principle the Commissioning Work Package. As part of the review, agreement is reached as to the work necessary to achieve Practical Completion (W42F01). The Commissioning Engineer documents this review in the form of minutes, distributes a copy to all present and provides a copy for insertion in Section 1-1 of the Commissioning Work Package. This activity is completed 4 weeks before the scheduled start date of the Commissioning.

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9.9.6.12 Preparation of Work Instructions

The Commissioning Engineer documents all applicable Commissioning Activities onto work instructions using a standard form.

Work Instructions fall into three categories:

- Pre-Commissioning
- Commissioning
- Post-Commissioning.

A Work Instruction defines an activity in terms of tasks that are to be performed by an individual or team. Each team has a Team Leader.

A Task is one of a number of elements of work that are required to complete an Activity.

Each Work Instruction is entered on the applicable Register of Work Instructions and allocated a Register Number using the standard form. There are three Registers to cover Pre-Commissioning, Commissioning and Post Commissioning Work Instructions.

PR S 47117 Inspection and Testing of Signalling: Standard Forms, contains I.T.F's including checklists required for typical certification inspection and testing of Signalling apparatus. These checklists define the minimum requirements to be included in Work Instructions. Work Instructions however shall be tailored to suit the requirements of the particular system and equipment - updated to include new or altered requirements included in Specifications, Guidelines, Maintenance Manuals, Manufacturer's and Signal Engineering Instructions. Activities and Tasks shall be written using the terminology and context used in the Sydney Trains Infrastructure Engineering Specifications - Signalling and referenced documents. The use of informal terms and descriptions shall be avoided.

Each Work Instruction shall be set out so that each task can be checked off by the discipline Team Leader and that the number of activities on a Work Instruction can reasonably be expected to be completed in the time allocated.

Each Activity included in Work Instructions shall be provided with detailed description/s of the certification tasks requiring sign off as completed by the discipline Team Leader. Certification inspection and testing of multiple apparatus of the same type may be grouped on one Work Instruction. The individual apparatus may be listed (equipment description, type and number) for sign off below the task/activity descriptions provided that numbered tick boxes are included to record the completion of each task/activity.

When more than one team is planned to work on the same apparatus the Work Instruction shall include the requirement for the discipline Team Leader to verify with the Commissioning headquarters that the previous team has completed their works.

Each Work Instruction shall clearly identify the scope of the work required and include references to the Standards/Procedures/Drawings applicable.

If the "Work Description" requires more than one page, a second sheet may be used.

Document preparation shall be completed using current Sydney Trains Records Management standards and procedures.

Printed copies shall be produced for commissioning using colour coding to differentiate certified copies, i.e. white for preparation and information copies, yellow for implementation copies.

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Prepared registers are inserted in Section 2 of the Commissioning Work Package. Prepared Pre-Commissioning Work Instructions are inserted in Section 1-7. Prepared Commissioning Work Instructions are inserted in Section 1-8. Prepared Post-Commissioning Work Instructions are inserted in Section 1-9.

9.9.6.13 Preparation of Staffing Details

For each planned activity, the Commissioning Engineer nominates the team structure and individual licensing requirements to the Project Manager. The Project Manager in consultation with the Team Manager and Commissioning Engineer arranges to allocate appropriate specific personnel to fulfil the program, licensing and team structure requirements.

All personnel in the management and team structure from the Commissioning Engineer to the level of Team Leader conducting Signalling Safeworking, inspection and testing responsibilities shall be in possession of a current “Certificate of Competency” and Permit To Work applicable to the Works copies of which shall be inserted in Section 1-6 of the Commissioning Work Package. Appropriate supervision may be provided to allow individuals to gain experience where their Certificate of Competency requires them to “work under supervision” for the required task.

The Commissioning Engineer documents staffing details on the Commissioning Roster. The Commissioning Roster is inserted into Section 1-6 of the Commissioning Work Package.

When preparing the roster, the Project Manager, Team Manager and Commissioning Engineer are to consider the Sydney Trains policy and procedures for fatigue management.

9.9.6.14 Preparation of Final Commissioning Notice

The Commissioning Engineer amends and completes the Draft Commissioning Notice to produce the final Commissioning Notice that is inserted in Section 1-6 of the Commissioning Work Package.

Included in the notice is the date and time of the Post-Commissioning Meeting.

The notice also includes the details as set out in the relevant provisions found elsewhere in this Specification.

The Commissioning Engineer e-mails a copy of the notice to ICON.

9.9.6.15 Publication of Operations Documents

The Commissioning Engineer obtains proof and final copies of these documents and inserts them in Section 1-3 of the Commissioning Work Package.

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9.9.6.16 Pre-Commissioning Conference and Meeting

The Commissioning Engineer arranges a Pre-Commissioning Conference not less than two weeks prior to the commissioning start date in order to establish that all arrangements are in place to ensure a successful commissioning. The Commissioning Engineer and Project Manager attend along with representatives of Operational, Regional Signal Representative and the Regional Maintenance Engineer.

Following the conference, a Pre-Commissioning Meeting is held. This is attended by the Team Leaders, the Commissioning Engineer, and Regional representatives. At this meeting the site induction is completed, Commissioning Notice and white copies of the Work Instructions are issued.

Following the Pre-Commissioning Meeting the Team Leaders should visit the site to ensure that they are familiar with the required work, location of the H.Q, locations, materials, access and equipment necessary for the work, if practical.

If a Team Leader cannot attend the Pre-Commissioning Meeting (allowed only in special circumstances), the required notices and work instructions are to be forwarded to the Team Leader who should then arrange to visit site as above. The Commissioning Engineer arranges for the Team Leader to be inducted/briefed before the Team Leader starts work and retains a record of the briefing.

The Commissioning Engineer also ensures that representatives of other groups working within the Commissioning area attend the Pre-Commissioning Meeting. If this is not possible, the Commissioning Engineer (or delegate) inducts and briefs these representatives before they start work. The Commissioning Engineer should retain a record of the briefing.

The Commissioning Engineer records attendance for the Pre-Commissioning Meeting and prepares minutes for both the Pre-Commissioning Conference and The Pre-Commissioning Meeting. The minutes are distributed to those present and any other parties referred to in the minutes. A copy of each set of minutes and attendance list for the Pre-Commissioning Meeting is inserted in Section 1-10 of the Commissioning Work Package.

The Conference and Meeting are held two weeks before the scheduled start date of the Commissioning and the minutes are distributed within three working days of the Conference/Meeting.

9.9.6.17 Asset Register

As agreed in the Interface Coordination Plan, at least two weeks before the Commissioning, the Commissioning Engineer delivers details of the asset changes to the Regional Signal Representative and/or respective Control Systems Asset Engineer. Updates are provided by the Commissioning Engineer for amendments in the Pre-Commissioning/Commissioning periods. A copy is inserted into the Handover Documentation Package.

9.9.6.18 Authorisation of Commissioning Work Package

The Commissioning Engineer and the Regional Signal Representative and/or respective Control Systems Maintenance Engineer authorise the work package on the standard form. This authorisation is based on the review/s performed previously. The completed authorisation form is inserted in Section 1-1 of the Commissioning Work Package.

This activity is completed two weeks before the scheduled start date of the Commissioning.

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9.9.6.19 Pre-Commissioning Work Instructions

The Commissioning engineer ensures and expedites the issue, use and completion of the Pre-Commissioning work instructions. Any work instruction that is issued for implementation is registered and signed off by the authorising officer and is a yellow copy. The Commissioning engineer issues each work instruction to the applicable Team leader and at the same time records the “date” and “time” in the Pre-Commissioning work instruction Register and verifies that the correct Team leader is recorded on the register. The Team leader expedites the completion of the work instruction. When the Team leader returns the work instruction, the Commissioning engineer checks that the work instruction has been signed off by the Team leader that all tasks have been completed and that all supporting documentation is provided and is complete.

If the Pre Commissioning Work Instruction has not been fully completed the Commissioning engineer reviews the uncompleted tasks with the Team leader and determines the appropriate actions required.

When all tasks have been completed, the Commissioning engineer signs the Received, Checked, and Action statement and completes the Register, both the “Complete” and “Checked” columns.

Completed Pre Commissioning Work Instructions are inserted into Section 2 of the Work Package.

To enable a particular Pre Commissioning Work Instruction to be signed off, incomplete tasks can be transferred to a new Work Instruction and this fact noted on the Work Instruction from which they were taken.

New Work Instructions prepared by the Commissioning engineer are to be included in the Register of work instructions with the date and time of issue.

All Pre-Commissioning Work Instructions are to be completed and signed off before the commencement of the Commissioning. All uncompleted Pre-Commissioning tasks shall be transferred to Commissioning Work Instructions or Post-Commissioning Work Instructions.

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9.10 Commissioning Work Package – Phase 2 Implementation During Commissioning

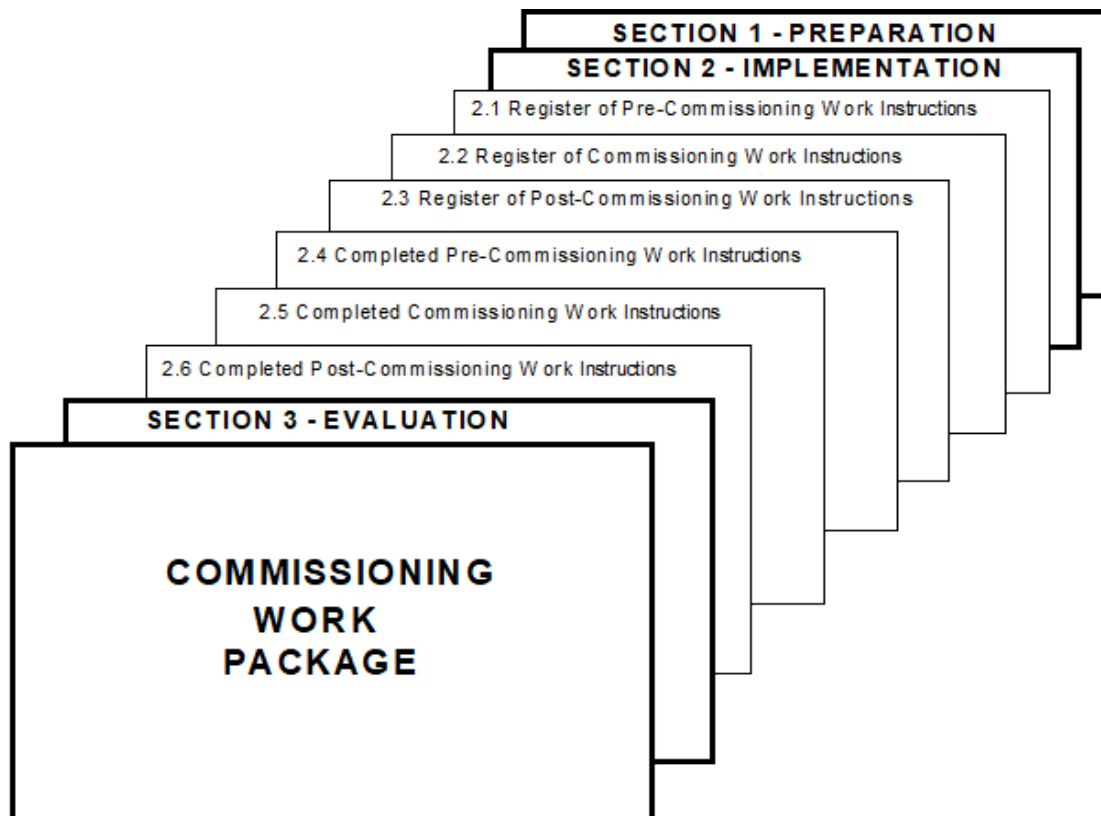


Figure 6: Commissioning Work Package Phase 2

9.10.1 Purpose

The purpose of this procedure is to provide directions for the implementation of the Commissioning Work Package.

9.10.2 Scope

This procedure covers the steps to be taken during Phase 2, the Implementation Phase for the Commissioning Work Package. This phase is called the Commissioning Period, which starts when the existing equipment is "booked out of use" and ends when the new works are "brought into use".

9.10.3 Applicability

It is a requirement that a Commissioning Work Package as described in this procedure is prepared for each Commissioning.

Minor Signalling is documented as set out in Section 11 of this document.

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9.10.4 Responsibility

9.10.4.1 Management, Engineering and Construction Personnel

For Project Manager, Regional Signal Representative, Commissioning Engineer, Team Managers, Site Managers and Work Group Leaders - refer to *PR S 47111 Inspection and Testing of Signalling: Roles, Responsibilities and Authorities*.

9.10.4.2 Deputy Commissioning Engineer/s

Fulfil the role of Commissioning Engineer during absences of the Commissioning Engineer; receive handover and hand back during overlapping shifts. Handover to include details and location of work teams, progress report, details of outstanding actions from Work Instructions and the Commissioning Log requiring resolution.

When shifts do not overlap the vacating authorised officer shall write a written report containing the required details prior to finishing their shift.

9.10.4.3 Team Leaders

Responsible for performing the work to the Sydney Trains Standards, Manuals and Instructions and performing the work as delegated by the Commissioning Engineer and/or detailed on the Commissioning Work Instructions, completing, signing and returning work instructions to the Commissioning headquarters.

Report to the Site Manager/Work Group Leader all defects, defective material, incidents and items requiring further action related to the performance of the installation, inspection, testing and Commissioning of the works.

9.10.4.4 Work Package Controllers

When the Commissioning is considered large or complex, the Commissioning Engineer includes a Work Package Controller in the management structure.

Work Package Controllers must be familiar with the scope and procedures for the Commissioning Work Package and the technical aspects of signalling.

The Work Package Controller reports to the Commissioning Engineer and is delegated the procedure for the issue and return of Commissioning Work Instructions and supporting documentation. Work Package Controllers review returned Work Instructions and documentation for completeness and refer any issues and outstanding actions to the Commissioning Engineer. Following each shift changeover, the Work Package Controller prepares the returned Work Instructions and Work Instruction Register for the Commissioning Engineer to check and sign off.

The Work Package Controller may also assist with the marking up of Interim Maintenance Copies of the design to include any Commissioning modifications.

9.10.5 Associate Procedures

- Commissioning Work Package Phase 1: Preparation Before Commissioning
- Commissioning Work Package Phase 3: Evaluation

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9.10.6 Procedure for Implementation Of Work Package

9.10.6.1 Signing on Duty

At the beginning of each shift, all personnel sign on for duty at the location nominated in the Commissioning Notice and sign on against their name in the Attendance Book.

9.10.6.2 Issue of Commissioning Work Instructions

Each Team leader reports to the Commissioning Engineer or Work Package Controller at the Commissioning headquarters.

The Team Leader is issued with the applicable Commissioning Work Instruction(s) from Section 1-8 of the Work Package. Included with each Work Instruction is all the documentation required by the Team Leader such as:

- blank forms
- circuit books
- signalling plans
- track insulation plans
- rail vehicle detection system set to work and test and certify forms
- track circuit/wheel sensor/point history cards.

When required, the Commissioning Engineer gives the Team Leaders any final instructions. Team Leaders should clarify any uncertainties they may have concerning the Work Instruction/s with the Commissioning Engineer.

The "Date/Time Issued" is recorded in the Register of Commissioning Work Instructions in Section 2-2 of the Work Package and the correct Team Leader verified in the Register.

The Commissioning Engineer signs off any new Work Instructions prior to issue for implementation and includes them in the Work Instruction Register.

The Commissioning Engineer retains a white copy of any new Work Instructions in Section 1-8 of the Work Package and prepares a yellow copy for issue.

9.10.6.3 Commissioning Log

The Commissioning Engineer should maintain a Commissioning Log. The first entry is made from the time that the first shift signs on for duty.

The last entry in the Commissioning Log is at the completion of the last shift of the Commissioning. This includes "stand by" shifts.

All activities and events not covered by Work Instructions are to be entered into the Log by the Commissioning Engineer. This includes all reports made by Team Leaders.

All activities or events that require further action are entered into the Log and the "Action" column completed. Further, details of all significant events are noted:

- Granting of Possession
- Power-out Permits issued
- Signalling Safeworking activities e.g. reports of activities associated with "Booking out or into use" and the use of bridging authorities
- Progress reports from Team Leaders

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- Reports of potential delays
- Details of defective equipment including new and old serial numbers
- Possession issues referred to the Regional Signal Representative and/or respective Control Systems Maintenance Engineer
- Progress reports from “other works”
- Incidents and/or near misses
- Environmental incidents and escalation details
- Complaints from the public and method of resolution.

The Commissioning Engineer is responsible for the entry of information and the control of the Log. The Work Package Controller or other suitable recorder may be selected to control the Log and enter information.

9.10.6.4 Performance of Work

Team Leaders deploy their teams to perform the tasks detailed on the applicable Work Instructions.

Team Leaders ensure that each task is completed including the completion of associated documents and records.

As each task is completed, the time is recorded on the Work Instruction.

Tasks that have not been completed or are partly completed are noted by giving full details in the "Work Not Completed" section of the Work Instruction.

9.10.6.5 Report on Progress

Team Leaders provide timely reports on their progress to the Commissioning headquarters in accordance with the requirements of the Commissioning documents.

9.10.6.6 Report Problems

Team Leaders promptly report any problems encountered to Commissioning headquarters.

9.10.6.7 Monitor Progress

The Commissioning Engineer monitors progress of the commissioning by reviewing reports of activities completed in the Commissioning Log.

Exception activities are reported in the Log.

A schedule is used to monitor progress throughout the Commissioning Period.

For signals work a Signalling Plan may be used to record equipment reported as Tested and Certified. Each item is highlighted as reported, this provides an overview of progress, identifies areas where progress is lagging and is a cross check to verify the completion of the test and certify activities included in the Commissioning.

9.10.6.8 Communications System

The delegated Site Manager/Work Group Leader provides technical support including management of batteries during the Commissioning.

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9.10.6.9 Prepare, Register and Issue New Work Instructions

Modifications (including modifications to the Control Systems Release document), incomplete Work Instructions or documentation, Commissioning Log items, defective equipment, changing Signalling Safeworking requirements, etc. shall be managed by the issue of new Commissioning Work Instructions or, if required, Post-Commissioning Work Instructions. For incomplete tasks the Commissioning Engineer shall review the circumstances with the Team Leader and, where required, new Work Instructions are prepared, authorised, issued and recorded in the Register of Work Instructions by the Commissioning Engineer.

The Commissioning Engineer registers all new Commissioning or Post-Commissioning Work Instructions.

Master Commissioning Work Instructions are stored in Section 1-8. Post-Commissioning Work Instructions are stored in Section 1-9 of the Commissioning Work Package.

9.10.6.10 Complete and Return Work Instructions

Team Leaders complete their Work Instructions and note any incomplete tasks and any comments on the applicable Work Instruction.

Team Leaders complete and sign off the "Work Status Statement".

Team Leaders report to the Commissioning Engineer or, if instructed, the Work Package Controller at the Commissioning headquarters with their Work Instructions and all associated documents and records.

9.10.6.11 Receive, Check, Action Returned Work Instructions

The Commissioning Engineer checks that the Work Instructions have been signed off by the Team Leader, that all tasks have been completed and that all-supporting documentation is provided and is complete.

The Commissioning Engineer signs the "Received, Checked, Action" statement on each Work Instruction and completes the Register of Commissioning Work Instructions by filling in the "complete date", "complete time", "checked date", "checked time" columns.

9.10.6.12 Transfer Incomplete Tasks to New Work Instructions

Only when all tasks on a Work Instruction are completed satisfactorily does the Commissioning Engineer sign the "Received, Checked, Action" statement. To enable a particular Work Instruction to be signed off, the Commissioning Engineer transfers uncompleted task to new Commissioning or Post-Commissioning Work Instruction(s). This fact is noted on the Work Instruction from which the tasks were transferred.

New or transferred Work Instructions are to be registered and authorised by the Commissioning Engineer before issue. The date and time of issue are recorded in the Register.

Newly prepared Commissioning Work Instructions are registered and filed in Section 1-8. Newly prepared Post-Commissioning Work Instructions are registered and inserted into Section 1-9 of the Commissioning Work Package.

All Commissioning Work Instructions are to be completed and signed off before the end of the Commissioning Period. All uncompleted tasks must be transferred to Post-Commissioning Work Instructions by the Commissioning Engineer.

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9.10.6.13 File completed Commissioning Work Instructions

The Commissioning Engineer files completed Commissioning Work Instructions in Section 2-5 of the Commissioning Work Package.

The corresponding white copies are removed from Section 1-8 and disposed of.

9.10.6.14 Signing Off Duty

Team Leaders only complete their duties after all their Work Instructions have been signed off by the Commissioning Engineer as received, checked and actioned.

The Commissioning Engineer then releases the Team Leader. The Team Leader and the team may then sign off duty.

9.10.6.15 Signing into use the New and Altered Signalling

The Commissioning Engineer checks the status of the works by progressively completing the items listed on the Commissioning Certificate.

The Commissioning Engineer reviews the Work Instructions and the Commissioning Log and if complete notes this in the status column and signs that item. Exception: Work Instructions cancelled or transferred to the Post-Commissioning period shall be specifically noted.

The Commissioning Engineer determines that the inspection and testing, Signalling Safeworking, Design Integrity, Operational Technology testing and certifications are complete and notes this in the status column and signs that item. Exception: Work Instructions cancelled or transferred to the Post-Commissioning period shall be specifically noted.

The Commissioning Engineer checks all required Mechanical/Relay/Route Control Locking Test Certificate PR S 40022 FM01 and/or Design Integrity Test Certificate PR S 40022 FM02 from the Design Integrity Team Leader and inserts copies into Section 1-2 of Work Package.

The Commissioning Engineer determines the status of:

- Type approvals
- Control Systems Release documentation
- Issued design documents, (each design document should be listed and individual status noted)
- Design modifications (each design modification should be listed and individual status noted)
- Track Circuit, Wheel Sensor and Point History Cards (complete and ready for delivery to site)
- Test and Certify Forms (complete)
- CBI certifications (complete)
- Exceptions - list any work not to be Commissioned, etc.

The Commissioning Engineer completes the status column as above, and signs that item.

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The Commissioning Engineer liaises verbally with the Signaller and other disciplines ensuring that all required Certifications have been provided, i.e. Track, Civil, Electrical and/or Overhead Wiring have signed the Infrastructure Booking Authority form NRF 003. The Commissioning Engineer, when satisfied the works are inspected and tested, fit for purpose and safe to be commissioned into use, completes and signs the Commissioning Certificate.

The Commissioning Engineer arranges removal of Signal “X boards” and protection and books the equipment into use in accordance with the Network Rules and Procedures.

The Commissioning Engineer completes and forwards the relevant handover documentation as outlined in Sydney Trains document *AMD-AMP-GD-001 Asset Handover for Maintenance Guideline*.

9.11 Commissioning Work Package – Phase 3 Evaluation

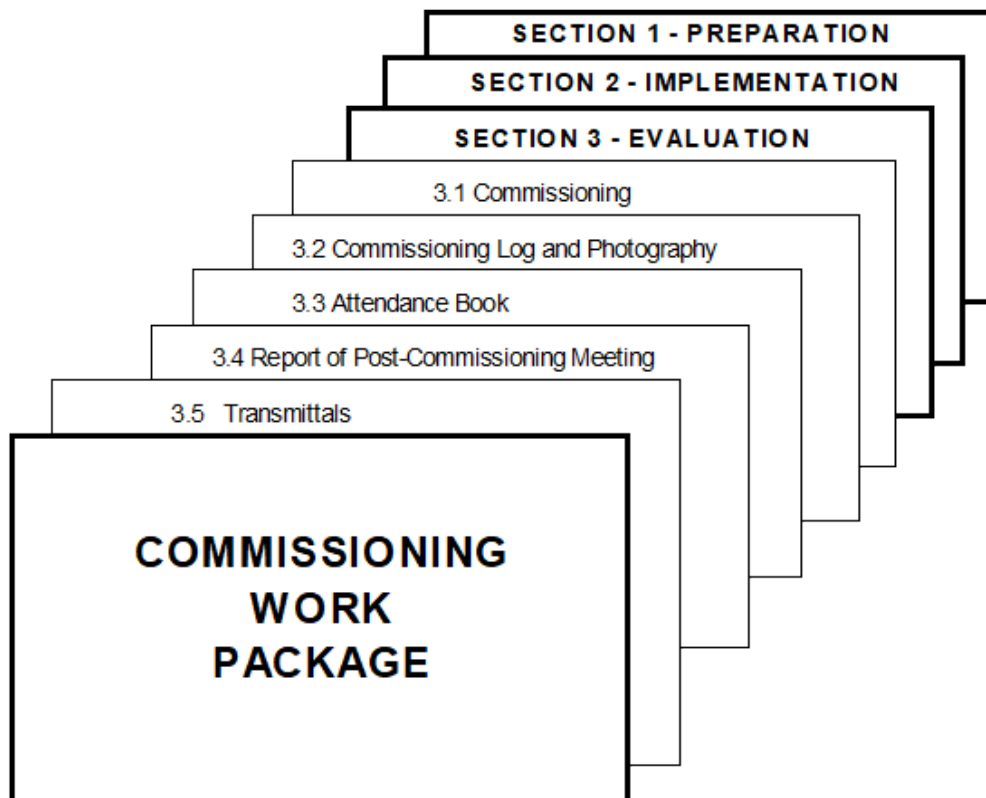


Figure 7: Commissioning Work Package Phase 3

9.11.1 Purpose

The purpose of this procedure is to provide directions for the evaluation of the Commissioning Work Package.

9.11.2 Scope

This procedure covers the steps to be taken during Phase 3, the Evaluation Phase for the Commissioning Work Package.

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9.11.3 Applicability

This procedure is applicable to all commissioning of New and Altered works.

9.11.4 Responsibility

9.11.4.1 Management, Engineering and Construction Personnel

For Project Manager, Regional Signal Representative, Commissioning Engineer, Team Managers, Site Managers and Work Group Leaders - refer to *PR S 47111 Inspection and Testing of Signalling: Roles, Responsibilities and Authorities*.

9.11.4.2 Team Leaders

Responsible for performing the work to the Sydney Trains Standards, Manuals and Instructions and for performing the work detailed on the Post-Commissioning Work Instructions, completing signing and returning Work Instructions.

9.11.5 Associated Procedures

- Preparation of Commissioning Work Package
- Implementation of Commissioning Work Package.

9.11.6 Procedure for Evaluation Of Work Package

9.11.6.1 Safeworking Forms and Permits

The Commissioning Engineer checks that all Safeworking Forms and Permits and Signalling Safeworking records (complete and signed off) are included in Section 1-2.

The Commissioning Engineer utilises the Checklist in Section 1-2 to ensure that all forms, permits and records are included.

9.11.6.2 Check Commissioning Log and Photography

The Commissioning Engineer checks the Commissioning Log to ensure that all entries requiring follow up action in the Post-Commissioning Period are identified.

Where appropriate an uncompleted activity is transferred to a new Post-Commissioning Work Instruction. Details are to be noted in the Commissioning Log.

The Commissioning Engineer collates all digital photography from the Commissioning into descriptive folders on suitable media or includes a text document description to clarify situations or intent.

The Commissioning Engineer inserts the Commissioning Log and Photography into Section 3-2.

9.11.6.3 Attendance Book

The Commissioning Engineer inserts a copy of the Attendance Book for the Commissioning into Section 3-3.

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9.11.6.4 Post Commissioning Work Instructions

The Commissioning Engineer ensures and expedites the issue, use and completion of the Post Commissioning Work Instructions.

The Commissioning Engineer issues each Post-Commissioning Work Instruction to the applicable Team Leader, records the "date issued" and "time issued" in the Post Commissioning Work Instruction Register and verifies that the correct Team Leader is recorded in the Register.

Any Work Instruction that is issued for implementation is signed off by the Commissioning Engineer.

When the Team Leaders return their Work Instructions, the Commissioning Engineer checks that the respective Post-Commissioning Work Instruction has been signed off by the Team Leader, that all tasks have been completed and that all supporting documentation is provided and is complete.

The Commissioning Engineer signs the "Received, Checked, Action" statement on each Post-Commissioning Work Instruction and completes the Register of Post-Commissioning Work Instructions by filling in the "complete date", "complete time", "checked date", "checked time" columns.

The Commissioning Engineer files completed Post Commissioning Work Instructions in Section 2-6.

All Post-Commissioning Work Instructions are to be completed and signed off before the Post-Commissioning Meeting.

9.11.6.5 Review of Work Status

The Commissioning Engineer checks:

- The status of all Pre-Commissioning, Commissioning and Post-Commissioning Work Instructions.
- The Commissioning Log and the Commissioning Certificate(s).
- The remainder of the Work Package for completeness.

All uncompleted tasks and activities are compiled in a list that is tabled at the Post-Commissioning Meeting.

9.11.6.6 Post Commissioning Meeting

Within two weeks of the end of the Commissioning Period, the Commissioning Engineer holds the Post Commissioning Meeting.

The purpose of the meeting is to identify, review and record all uncompleted activities and tasks and to identify dates and responsibilities for their completion.

The meeting is attended by the Regional Signal Representative, project management, Commissioning and Deputy Commissioning Engineer/s, Site Manager and Work Group Leaders, Work Package Controllers and any other key personnel identified by the Commissioning Engineer.

The Commissioning Engineer prepares a report of the meeting and issues a copy to those present within three days of the Meeting. A copy is inserted in Section 3-5.

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9.11.6.7 Delivery of Work Package

If agreed as part of the Project Work Notification the Commissioning Engineer delivers a copy of the completed Commissioning Work Package/s to the Regional Signal Representative and/or respective Control Systems Maintenance Engineer.

This is done under cover of a Document Transmittal signed by Regional Signal Representative and/or respective Control Systems Maintenance Engineer and a signed receipt acknowledgment is obtained.

9.11.6.8 Storage of Work Package

Within 4 weeks of the end of the commissioning period, the Commissioning engineer enters the Inspection and Testing Plan, Installation Work Package, Commissioning Work Package/s into the current Sydney Trains record management system and arranges the archiving of the originals in accordance with the current processes and practices and arranges to update the Project Documentation Register accordingly.

9.11.6.9 Storage of Test Copies of Design Documents

Within 4 weeks of the end of the Commissioning Period, the Commissioning Engineer enters all “Pink or Yellow” design documents used for inspection and testing of the Works into the current Sydney Trains record management system and arranges for the archiving of the originals in accordance with the current processes and practices.

10 Handover Package

The Commissioning Engineer shall hand over to the Regional Signal Representative and/or respective Control Systems Maintenance Engineer a package of signed off documents certifying that the project deliverable has been provided except for minor defects listed and programmed for rectification.

The Hand-over Package shall include copies of transmittal documents and acknowledgment receipts for:

- Asset Register information
- Interim Maintenance Copies of Design Documents
- Spare Equipment
- Copy of Commissioning Work Package (where applicable)
- “As built” copies of site documentation and drawings, e.g., Detailed Site Survey Drawings, Signal Sighting Checklist & Forms, Installation Drawings, Equipment Housing Layout Plans, Mechanical Drawings, Structures and Buildings, Clearance Diagrams, Level Crossing Layout Plans
- Control Systems Release build
- Copies of any other documents required to be provided as agreed on the Project Work Notification.
- The Hand-over Package shall also include a copy of:
 - Practical Completion Certificate (AMD-AMI-FM-001)
 - Copy of Defects and Omissions.

A copy of Final Certificate (AMD-AMI-FM-002) signed by the Commissioning Engineer when all known defects and omissions have been satisfactorily rectified and completed shall be provided and added to the package when available.

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11 Minor Work Package

11.1 Purpose

Minor Signalling Work, as defined in PR S 47110 may be documented as follows.

The principal objective for documentation of Minor Signalling Work is to provide process control using traceable records that evidence that the works have been planned, implemented, inspected, tested, commissioned and handed over in accordance with the requirements of the Standards, Specifications, Procedures, Manuals, Guidelines and Instructions.

These provisions do not override by omission any of the specific requirements set out in the Standards, Specifications, Guidelines and Instructions. The process for development of a Minor Works Package shall consider the necessity for and additionally include (where relevant) any elements, principles and process controls nominated for Major Signalling Work particular to the scope of works.

11.2 Scope

11.2.1 General

This procedure defines the minimum requirements for the documentation, planning, implementation, inspection, testing, and handover of Minor Signalling Works.

11.3 Applicability

These provisions shall be applicable to the documentation of Minor Signalling Work that the Regional Signal Representative and/or respective Control Systems Maintenance Engineer and the Commissioning Engineer have agreed as meeting the definition included in *PR S 47110 Inspection and Testing of Signalling: Introduction*. The agreement shall be documented in the Interface Coordination Plan.

Minor Signalling Work shall only be tested and/or commissioned at times where the risks of, overlaps, interfaces and design precedence have been considered (including other Minor Signalling Work). If the Commissioning Period and the physical boundaries / interfaces/design of the planned Commissioning of Minor Signalling Work coincide or overlap with the Commissioning of any other signalling work, these Minor Signalling Work package provisions shall not be applicable. The scope shall be fully investigated and if the design/s and scopes are compatible shall be integrated into a Major Signalling Work Package and Inspection and Testing Plan and implementation revised to include the additional activities and interfaces.

11.4 Applicability Documents

Sydney Trains Infrastructure Engineering Specifications - Signalling – Inspection and Testing of Signalling:

- MN S 40000 Signalling Safeworking Procedures
- Signal Engineering Guidelines
- Signal Engineering Instructions
- Personnel training, licensing and logbook documents
- Sydney Trains Infrastructure Engineering – Signalling Construction Standards.

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11.5 Responsibility

11.5.1 Management, Engineering and Construction Personnel

For Project Manager, Regional Signal Representative, Commissioning Engineer, Team Managers, Site Managers and Work Group Leaders - refer to *PR S 47111 Inspection and Testing of Signalling: Roles, Responsibilities and Authorities*.

11.5.2 Team Leader

Responsible for performing the work to the Sydney Trains Standards, Manuals and Instructions and for performing the work detailed on the Work Instructions, completing signing and returning Work Instructions.

Report to the Site Manager/Work Group Leader and Commissioning Engineer all defects, defective material, incidents and items requiring further action related to the performance of the installation, inspection, testing and commissioning of the works.

11.6 Procedure

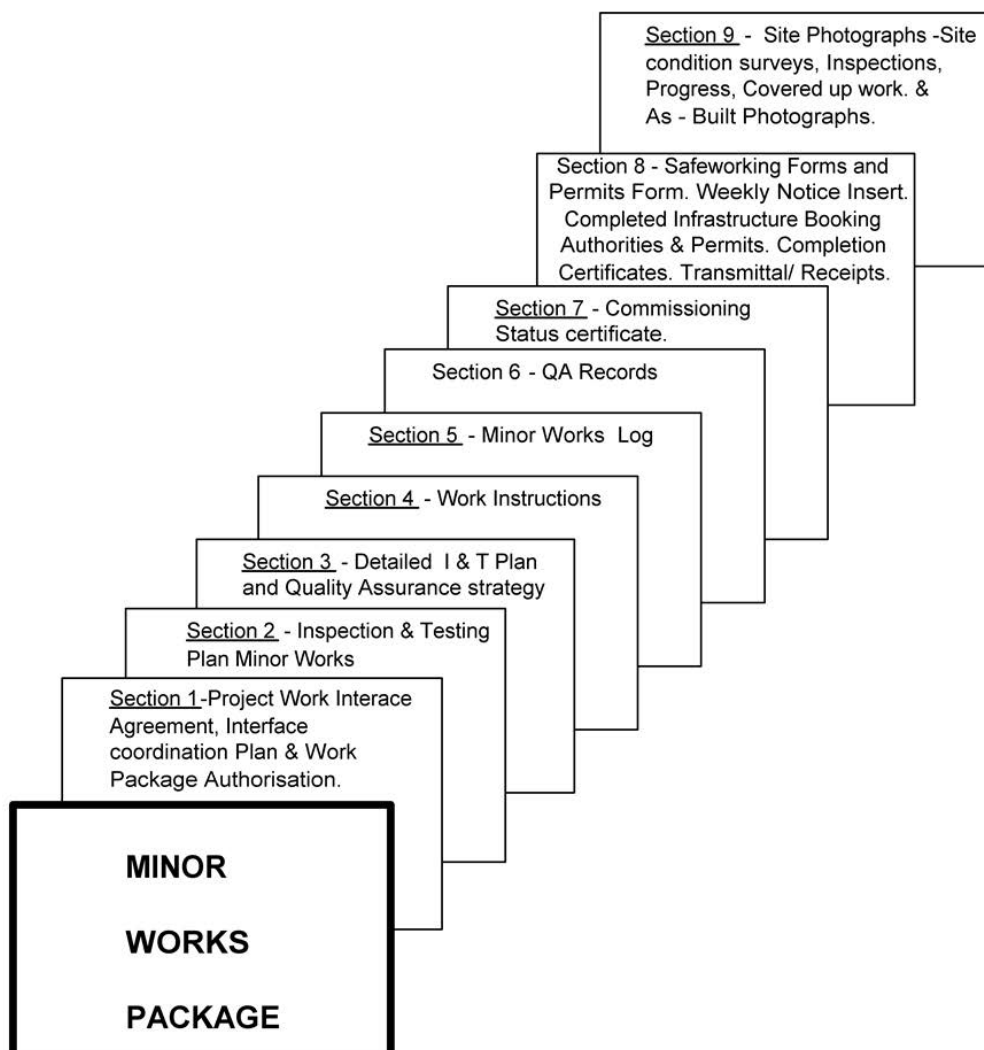


Figure 8 Minor Works Package Structure

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11.6.1 Preparing the Minor Works Package

The documents and forms referenced below can be found in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*.

11.6.1.1 Section 1

Project Work Notification and Interface Coordination Plan and Work Package Authorisation are filed in this section. The Regional Signal Representative and/or respective Control Systems Maintenance Engineer collaborates with the Commissioning Engineer to reach agreement for a Project Work Notification and an Interface Coordination Plan in accordance with *PR S 47116 Inspection and Testing of Signalling: Interface Requirements and Procedures For Alterations*, and Infrastructure Division requirements.

"Minor Works Package - Authorisation" cover sheet - The Commissioning Engineer registers and prepares the "Minor Works Package - Authorisation" cover sheet. The Authorisation sheet details to be provided include:

- **Region and Location/s of the Works** – This is the name of the Infrastructure Region responsible for the works and the location/s of the work.
- **Work Package Register Number** – This is the Registration number generated by the Sydney Trains records management system.
- **Approved Design Details** - This is a listing of the design documents issued by the Regional Signal Representative applicable to the works and version status. The descriptions shall be as shown on the documents including the design job number.
- **Scope of Works** –Reference the Project Scope of Works Document.
- **Prepared by: Commissioning Engineer** – This is the name of the Commissioning Engineer.
- **Approved in Principle by: Regional Signal Representative** – This is the name of the nominated Regional Signal Representative.
- **Sign Off** – When the Minor Works Package has been prepared, reviewed and is ready for use, the Commissioning Engineer signs off the cover sheet under "Prepared By" and at least 4 weeks prior to the work commencing submits and/or arranges to meet with the Regional Signal Representative to review the package. When the Regional Signal Representative is satisfied that the document includes the Infrastructure Division requirements, Project Work Notification and Interface Coordination Plan signs off under "Approved In Principle By". The timing shall be arranged to ensure agreement at least 2 weeks prior to the commencement of site work.

11.6.1.2 Section 2

Inspection and Testing Plan Minor Signalling Works – This is job specific version controlled document listing the following details:

- Names and types of new or altered signalling and telecommunications assets to be bought into use.
- Control Systems 'Release' documentation.
- Names and types of new signalling and telecommunications assets to be removed.
- A list of all Signalling Safeworking requirements, e.g. Bridging Authorities, Equipment to be "Booked out of Use" and Disconnected, Testing of Interlockings, Rerailing/Traction Return provisions including requirements for temporary design, Signal Engineering deviations and concessions, Electrical – mechanical and pneumatic risk assessments.

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- Other requirements e.g. Possession requirements to construct and commission the works including, test locomotive, electrical permits, worksite protection requirements and level crossings affected:
 - Listing of other disciplines/parties involved with the works
 - Personnel requirements. How many of what
 - Special Training Requirements. Details if any
 - Special Considerations. List if any, e.g. Axle Counter track sections Unconditional Reset Enable (URE) requirements
 - Deviations and Concessions Requirements. List if any.

11.6.1.3 Section 3

Minor Works, Installation – Inspection – Testing/Commissioning Detailed Plan & Signalling Safeworking Requirements – The Commissioning Engineer prepares this form. They are used to plan the Work Instructions required to implement the nominated activities for each piece of apparatus and Signalling Safeworking requirement. Activities to be planned include detailed operational function checking prior to bringing into use.

Minor Works, Installation – Inspection – Testing Quality Assurance Strategy – Notification, Witness and Hold Points – The construction specifications set out the installation standards, inspection, pass/fail criteria for signalling work. The Commissioning Engineer analyses the particular requirements for the scope of work and prepares this form. This is also used to plan the notification, witness and hold points required when implementing the nominated activities.

11.6.1.4 Section 4

11.6.1.4.1 Work Instructions

The Commissioning Engineer produces the Work Instructions as nominated in the “*Minor Works, Installation - Inspection – Testing - Commissioning Detailed Plan and Safeworking Requirements*” form/s in accordance with the requirements of the Standards, Specifications, Instructions and Guidelines.

PR S 47117 Inspection and Testing of Signalling: Standard Forms, contains I.T.F’s including checklists required for typical commissioning stage certification inspection and testing of signalling apparatus. These checklists define the minimum requirements to assist in the formulation of Work Instructions. Work Instructions however shall be tailored to suit the requirements of the particular system and equipment - updated to include new or altered requirements included in Specifications, Guidelines, Maintenance Manuals, Manufacturer’s and Signal Engineering Instructions. Activities and Tasks shall be written using the terminology and context used in the Specifications and referenced documents. The use of informal terms and descriptions shall be avoided.

A Work Instruction defines an Activity in terms of Tasks that are to be performed by an individual or team. Each team has a Team Leader.

Each Work Instruction shall be set out so that each Task can be checked off by the Team Leader and that the number of activities on a Work Instruction can reasonably be expected to be completed in the time allocated.

Where applicable - Test and Certify Forms from *PR S 47117 Inspection and Testing of Signalling: Standard Forms*, shall be attached to the Work Instruction.

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Each activity included in Work Instructions shall be provided with detailed description/s of the certification tasks requiring sign off as completed by the Team Leader. Certification inspection and testing of multiple apparatus of the same type may be grouped on one Work Instruction. The individual apparatus may be listed (equipment description, type and number) for sign off below the Task/Activity descriptions provided that numbered tick boxes are included to record the completion of each Task/Activity.

Work Instructions shall be prepared and disconnection lists attached to assist with the control of disconnection and restoration of Signalling apparatus.

Each Work Instruction clearly identifies the scope of work of the Instruction and references the Standards/Procedures/Drawings applicable.

If the “Work Description” requires more than one page, a second sheet is used.

Colour coding, i.e. white for preparation, yellow for implementation shall differentiate preparation and implementation copies of work instructions.

New Work Instructions required following the Minor Works Package sign off shall be detailed and recorded in the “Minor Signalling Works - Installation, Inspection, Testing and Commissioning Log” (Minor Works Log).

Prepared and completed Work instructions are filed in Section 4 of the Minor Works Package.

11.6.1.5 Section 5

Minor Signalling Works - Installation, Inspection, Testing and Commissioning Log (Minor Works Log).

The Commissioning Engineer prepares the required Log sheets.

11.6.1.6 Section 6

The Commissioning Engineer may prepare a list of required records.

11.6.1.7 Section 7

The Commissioning Engineer prepares a standard Commissioning Certificate and inserts it into Section 7.

11.6.1.8 Section 8

The Commissioning Engineer analyses the requirement and prepares a Safeworking Forms and Permits Form to document the requirement. The prepared form is inserted into Section 8.

The Commissioning Engineer inserts all transmittals/receipts for Design into this section.

Notification of the Works in Weekly Notice – Preparation of Weekly Notice Insert

The Commissioning Engineer initiates via the Regional Signal Representative to arrange the publication of the Weekly Notice and Drivers Diagram for the agreed dates. The Regional Signal Representative provides draft copies of the write up for the Weekly Notice and Drivers Diagram insert, and/or circular to the Commissioning Engineer for comment. Copies of the request and progressive issues of the documents are inserted in Section 8 of the Minor Works Package.

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Booking Out and Restoration of Signalling Apparatus – The Commissioning Engineer prepares the Infrastructure Booking Authority (IBA) form NRF 003. Copies of prepared then completed IBA documents are inserted in Section 8 of the Minor Works Package.

11.6.1.9 Section 9

The Commissioning Engineer arranges for appropriate digital photography of the site. The storage media is progressively collated and inserted/recorded into Section 9. Separate folders on the storage media shall describe the purpose and location of the subject. Photography shall include:

- Condition of the site prior to the commencement of work, fencing, drainage and existing infrastructure.
- All work subject to inspection and testing prior to being covered up including foundations and trenches.
- General progress and good workmanship.
- Completed work.
- Minor defects agreed at Practical Completion and the rectification work.

Where appropriate a text document shall be created (and included in the particular folder on the storage media) to describe the location, apparatus, purpose, situation, and reasoning intended to be conveyed in the photographs.

11.6.2 Implementing the Minor Works Package

The Commissioning Engineer briefs personnel as to the package requirements, monitors the implementation and updates the package as required.

Where independence is assured the Commissioning Engineer may delegate specific QA inspections associated with the nominated notification/witness and hold points.

Minor Works Log - The first entry is made to nominate the time, date of commencement of site activities, and nominate the Site Manager, Work Group Leader/s, and Team Leader/s who are maintaining portions of the Log for their activities.

Site personnel maintaining portions of the Log - circle their respective position and enter their name on each page.

Items entered for information purposes that do not require follow up action are distinguished by writing “**NOTE**” in the action column.

New and altered Work Instructions required following the Minor Works Package “Sign off” shall be detailed and recorded and followed up in the Minor Works Log.

All activities and events not covered by Work Instructions are to be entered into the Log by the Commissioning Engineer, Test Engineer, Site Manager, Work Group and Team Leaders.

All activities or events that require further action are entered into the Log and the "Action" column completed. Further, details of all significant events are noted:

- Details of QA Strategy Notifications, witness and hold points
- Project milestones, work commencements, delays and completions
- Scope variations and approvals
- Defects and, defective materials (notification and rectification)
- Incidents, near misses and delays

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- Items requiring further action related to the performance of the installation, inspection, testing and commissioning of the works
- Use of Possessions
- Power - Out Permits issued
- Progress reports from Team Leaders
- Possession issues referred to the Regional Signal Representative
- Environmental incidents and escalation details
- Complaints from the public and method of resolution
- The Commissioning Engineer is responsible for the review, follow up, and “Sign off” of actions and controlling the Log.

The last entry in the Log is at the completion of defects rectification and Final Certificate.

All Log sheets are progressively numbered and stored in Section 5 of the Minor works Package.

The Commissioning Engineer closes the Log.

Inspection and Testing Records - The Commissioning Engineer issues and as installation inspections and tests are completed stores completed Work Instructions into the Minor Works Package.

Quality Records - The Commissioning Engineer, Site Manager and Work Group Leaders obtain and insert in this section QA records of all installed equipment and the records providing evidence of the satisfactory completion of the items nominated in the “Minor Works Installation – Inspection – Testing Quality Assurance Strategy”.

All QA records of supplied equipment and the inspections of installed equipment are progressively included in Section 6 of the Package.

11.6.3 Evaluation of the Minor Works Package

Prior to bringing into use the Commissioning Engineer:

- Examines the design documents to verify that all inspections; circuit, function and system tests have been completed and documented in the final versions.
- Checks that all Work Instructions have been issued and satisfactorily completed.
- Checks the Work Instructions to verify that the required inspection and test records have been attached and that the Work Status Statements and Received/Checked/Action Statements are signed.
- Examines the Minor Works Package Log to ensure satisfactory completion or any non-essential outstanding Activities have been noted for Post-Commissioning attention.
- Checks the operational functionality of the signalling apparatus in accordance with the design.

Commissioning Certificate – The Commissioning Engineer completes the Commissioning Certificate using the standard form included in *PR S 47117 Inspection and Testing of Signalling: Standard Forms*.

Bringing into use – Following the completion of the Commissioning Certificate the Commissioning Engineer may certify that the alterations or additions are fit for purpose and may be commissioned using the Infrastructure Booking Authority (IBA) form NRF 003.

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Interim Maintenance Copies (IMC) – On completion of the commissioning (or prior for ETCS L1 LS/ASDO works) and as soon as reasonably possible, the Commissioning Engineer is to:

- Provide a digital copy (pdf) of the IMC to the signal design team by emailed.
- Issue Interim Maintenance Copies of working drawings to the Regional Signal Representative and/or respective Control Systems Maintenance Engineer. This is done under cover of a Transmittal document.

Certified Office Copies (C.O.C.) - The Commissioning Engineer returns C.O.C.'s of working drawings (within 28 days) to the Regional Signal Representative and/or respective Control Systems Maintenance Engineer and issues Interim Maintenance Copies of working drawings. This is done under cover of a Transmittal document.

For return of design documentation, refer Section 2.5.

11.6.4 Handover

Handover requirements shall be in accordance with Section 10 and documents inserted into Section 8 the Minor Works Package.

11.6.5 Storage of the Minor Works Package

Where required and agreed in the Interface Coordination Plan the Commissioning Engineer issues a copy of the Minor Works Package to the Regional Signal Representative.

As soon as practicable following completion of the works, the Commissioning Engineer arranges for the archiving of the original of the Minor Works Package in accordance with the current Sydney Trains standards and procedures.

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