AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Signalling) **Category: Standard**

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

ESC-21-02

Applicability

ARTC Network Wide	✓	**CRIA (NSW CRN)**	✓

Primary Source

SCP 07, S2, VRIOGS 012.5-200X

Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.2	13 August 2010	Standards	Stakeholders	Chief Operating Officer	Risk & Safety Committee 09/06/2009

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	27 Apr 09		First issue. Supersedes in part NSW Standard SCP 07 v1.2 and SA/WA Standard S2 v1.1
1.1	07 Oct 09		Disclaimer updated as per Risk & Safety Committee 14/09/2009
1.2	13 August 2010	All	Issued as final.

Contents

1 Introduction

1.1 General

This Standard 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 ARTC 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 ARTC Engineering Procedures 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 accredited, 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 Standard, in conjunction with the other ESC-21-00 series Standards defines such a verification and validation process.

1.2 Interface Documentation Requirements for Network Control and Telecommunications Systems

Signalling control systems and telecommunications systems are the responsibility of the Communications and Control Systems Group. At commissioning, the train control or telecommunications system group representative shall provide the agreed final certification documentation attesting that the system has been inspected, tested and certified fit for purpose and reliability.

The certification documentation requirement to be provided to the Commissioning manager shall be analysed and agreed at the inspection and testing planning phase of the project and be documented in an Interface Coordination Plan between the parties. Further, for commissioning and stagework, collaboratively program and plan any access priorities, resource sharing opportunities and the terminologies to be used to conduct the testing activities.

In addition to an effective Quality management system and processes, the Train control and telecommunications system Certification documentation shall be comparable to the requirements for signalling systems contained herein.

At commissioning the agreed certification documentation shall be provided in a timely manner to enable the signalling Commissioning manager to sign into use the interface and/or the integrated system/s.

Where the system/s are bought into use at a later date using a previously commissioned interface - the Communications and Control Systems Group shall be responsible to independently document, certify and bring the train control or telecommunications system into use. Using appropriate competent staff as Commissioning Manager.

1.3 Definitions

"*Minor*" and "*Major*" *signalling work* definitions are set out as follows for the guidance of signal engineers primarily to define the requirements for the preparation of inspection and testing plans and documentation packages.

Major Signalling Work

The term "*Major signalling work*" covers all new and altered construction work that is, not "*Minor signalling work"*. These may range in scale from smaller projects up to resignalling projects extending over several years.

Whatever the scale of the project, "*Major signalling work*" involves the use of multi-stage documentation for the planning and implementation of the installation, testing and commissioning.

Examples of work likely to be classified as "*Major signalling work*" include:

- Involves multiple teams working inter-dependently that requires coordination or sequential changes,
- Any work that requires Design Integrity Testing by a Signal design engineer.

Minor Signalling Work

The term "*Minor signalling work*" covers changes to signalling infrastructure having the following characteristics:

- It involves minor changes to the signalling infrastructure,
- Involves the use of single stage documentation for the planning and implementation of the installation, testing and commissioning,
- It may be a single change,
- It may be a sequence of similar but independent changes, (eg conversion of signal aspects to L.E.D). Each alteration from book-out to book–in will be of a short duration (by the same personnel within one shift or possession). Or may be a sequence of independent changes, with a program scope extending over several days or even weeks, eg progressive upgrading of existing individual - signals, trainstops, track circuits, point drives or level crossings,
- A single work team is carrying out each change, with no work, that needs to be coordinated with that of other signalling teams working in the same area implementing other works,
- It may be carried out simultaneously by multiple teams working independently (without any interfaces or overlaps) of each other,
- The work is to be planned, implemented and commissioned under the control of one individual Commissioning manager.

Examples of work likely to be classified as *Minor Signalling* work include:

Like for like with minor adaptations	Change point machine LED conversion with changed lamp proving
Additional item without changes to existing wiring	Repeater signal Warning light
Additional item with minor changes to existing wiring, but not interlocking	Level crossing monitor Surge protection Power supply or ECO upgrade Telemetry Interface Change Signals Relocate Signals

Emergency Work

The Inspection and Testing of Signalling Standards (ESC-21-01 to ESC-21-03 inclusive) set out the principles for personnel, planning, implementation, and evaluation of the work. In an emergency, should any or some of these requirements be not practicable the work may be planned and implemented in accordance with specific directions of the Manager Standards.

Train Control and Telecommunication Systems

This definition shall include the signaller interface / control systems and ATP systems interfacing with train drivers and/or on board train systems.

The definition does not include mechanical levers / illuminated diagrams, key or push button control panels.

1.4 Applicable Documents

This Standard shall be read in conjunction with the ARTC Standards, Procedures and work Instructions.

This Standard shall be read in conjunction with companion ARTC Engineering (Signalling) Standards -:

- ESC-21-01 Inspection and Testing of Signalling - Roles, Responsibilities and Authorities,
- ESC-21-03 Inspection and Testing of Signalling – Inspection and Testing Principles,
- ESC-21-04 Inspection and Testing of Signalling - Standard Forms,
- Signalling Maintenance Standards
- Glossary of Signalling Terms".

This Standard shall be read in conjunction with ARTC Engineering Stanadrd – Signalling for Equipment and Construction:

- As published on the Engineering pages of the ARTC Intranet.

Training and Competency Procedures as follows:

- Personnel training, competency and logbook documents

Signal Engineering Instructions and Guidelines:

- As issued from time to time and published on the Engineering pages of the ARTC Intranet.

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 whom need to access them in the normal course of their duties or as permitted by the Manager Standards.

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 manager if they find evidence of unaccountable or aborted work in the area.

Details of the required procedures are found in ESC-21-03 Inspection and Testing of Signalling - Inspection and Testing Principles.

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 Signalling Design Documentation

Signal Design shall be prepared, presented and used in accordance the relevant signal design 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.

2.3 Control Mechanism

The basic techniques used to control 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.

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 orange, 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 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 ever 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 (eg. 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 Managers to Consult

When an altered design is to be issued following the commencement of construction, it is important the Commissioning manager has a clear understanding on the extent of the changes. To ensure there is a clear understanding of what is required; Design engineers should consult with the Commissioning manager in order to clarify:

- The scope of alterations to the design and equipment changes, and,
- 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 Manager or Tester in Charge

The Commissioning manager or Tester in Charge shall prior to commissioning ensure that the design is up to date with the latest control sheet, and all pages are correct to the control sheet. Further, verify that testing has been planned or completed to the latest versions.

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

Commissioning manager shall return all Certified Commissioning Copies (C.C.C's) of the design as soon as is practicable (nominally within 5 days) following the completion of the works. Should this not be possible commissioning manager shall consult the Manager Standards.

2.6 Use of Modification Sheets

Modification record books shall comply with the requirements of the respective signalling standards and procedures. 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 & the use of formal control sheets are impractical. On each occasion a modification sheet is issued the design engineer shall consult with the Commissioning manager.

Commissioning managers 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 stapled into the C.C.C.

Design engineers should ensure that office copies of modification sheets are stapled into the office copy as soon as they return to the design office.

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

2.7 Site Control of Design Documents.

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

The colour design phases are; Master Test Copy "Pink" Vic "Blue" SA "Stamped" Approved for Commissioning / C.C.C / Interim Maintenance "Orange" Maintenance Copies "White" in Vic Removal of Circuits "Yellow" New Circuits "Red"

The Commissioning manager shall analyse the program and available resources and advise the Regional signal representative the number of site copies required to be issued by signal design of the construction, testing and commissioning documents. 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 managers 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 design. Functional changes occurring after the issue of "Yellow" 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 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 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.

2.8 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 COC. 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 manager. The Commissioning manager 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.

2.9 Site Control at Pre Commissioning Phase

At the completion of pre commissioning testing the Commissioning manager (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.

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 inspection and testing requirements. Allocate, clearly mark and register “testing copies” of the approved for commissioning 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.

2.10 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 . Each Modification Instruction Form shall be issued to the Commissioning manager 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 Certified Commissioning copies.

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

2.11 Site Control at Post Commissioning Phase

Certified Commissioning Copies of design (C.C.C's) shall be returned within 28 days to the Manager Standards 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. The retention period shall be as nominated by ARTC policies and procedures or for the life of the commissioned infrastructure. For Renewals division, the records shall be forwarded to the Senior Technical Team Manager.

3 Certification Documentation

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

Ensure that each element of the vital signalling 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.

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

1) Signalling Arrangement Plan
2) Track Circuit Bonding Plan
3) Circuit Book of signalling and communications circuits
4) Locking Table and Locking Diagram
5) Control Table
6) Design Integrity Test plan
7) Interlocking Tests

3.1.2 Adjustment

Ensure that the following document certifications are performed:

1) Points facing point lock and detection adjustment tests shall be specifically certified on Facing Point Lock and Detection Test Certificates
2) Track Circuit adjustment tests shall be specifically recorded and certified on Track Circuit History Cards
3) 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.

Alternatively an approved bell-megger test instrument may be used for internal circuits on a Go-No Go basis.

3.1.4 Clearances and Positional Relationships

Ensure that structure gauge clearances, train stop gauging etc and positional relationships between apparatus, eg. Signal / train stop/blockjoint, are included as part of the certification inspection to the Signalling / Track Plan, and Track Insulation Plan.

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

3.2 Interlocking Certification

Perform a test of interlocking between points, signals, etc. The Signal design engineer or Commissioning manager carrying out the interlocking test shall sign the Interlocking certification.

Interlocking tests shall be specifically certified on Interlocking Test Certificates as nominated in ESM-05-01.

For Computer Based Interlocking, the relevant "Installed Data Form" shall be certified and included in the Commissioning Works Package.

3.3 Design Tests and Principle Tests

Where more than one Signal design engineer is involved in design function testing then nominates 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.

3.4 Completed 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.

3.5 Other Documentation

Refer to the Specification ESD-25-01 Signalling Documentation and Drawings for details of further requirements for New and altered works

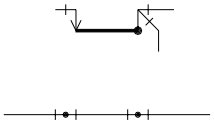
3.6 Method of Recording Tests on Design Drawings

See Over /.

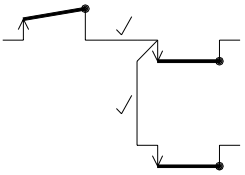
3.12 METHOD OF RECORDING TESTS ON DESIGN DRAWINGS

3.12.1 RECORDING ON CIRCUIT BOOK/SHEET

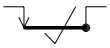
Wire count denoted on the circuit diagram by small stroke across the wire next to the terminal



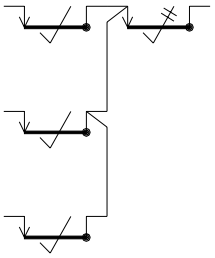
Bell continuity test denoted on circuit diagram by small tick next to the wire or by colouring the wire in



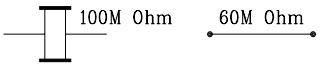
Circuit strap and function test of a contact denoted on circuit diagrams by a large tick through contact



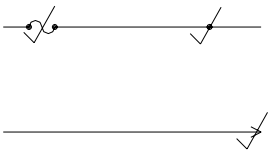
Contact strap and function test for more than one parallel path denoted by stoke across large tick for each additional path



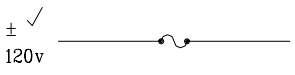
Circuit insulation test denoted on circuit diagram by recording test reading next to the circuit function for complete circuits or on individual circuit wires where applicable



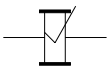
Circuit function test of fuses and link terminals denoted on circuit diagrams by large tick through fuse or terminal



Correct busbar voltage denoted on circuit diagrams by small tick next to the supply details



Circuit function test of a relay denoted on circuit diagrams by a large tick through the relay



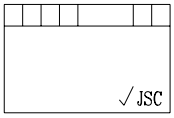
3.12.2 RECORDED ON ANALYSIS SHEETS

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

3.12.3 RECORDED ON CONTROL TABLES

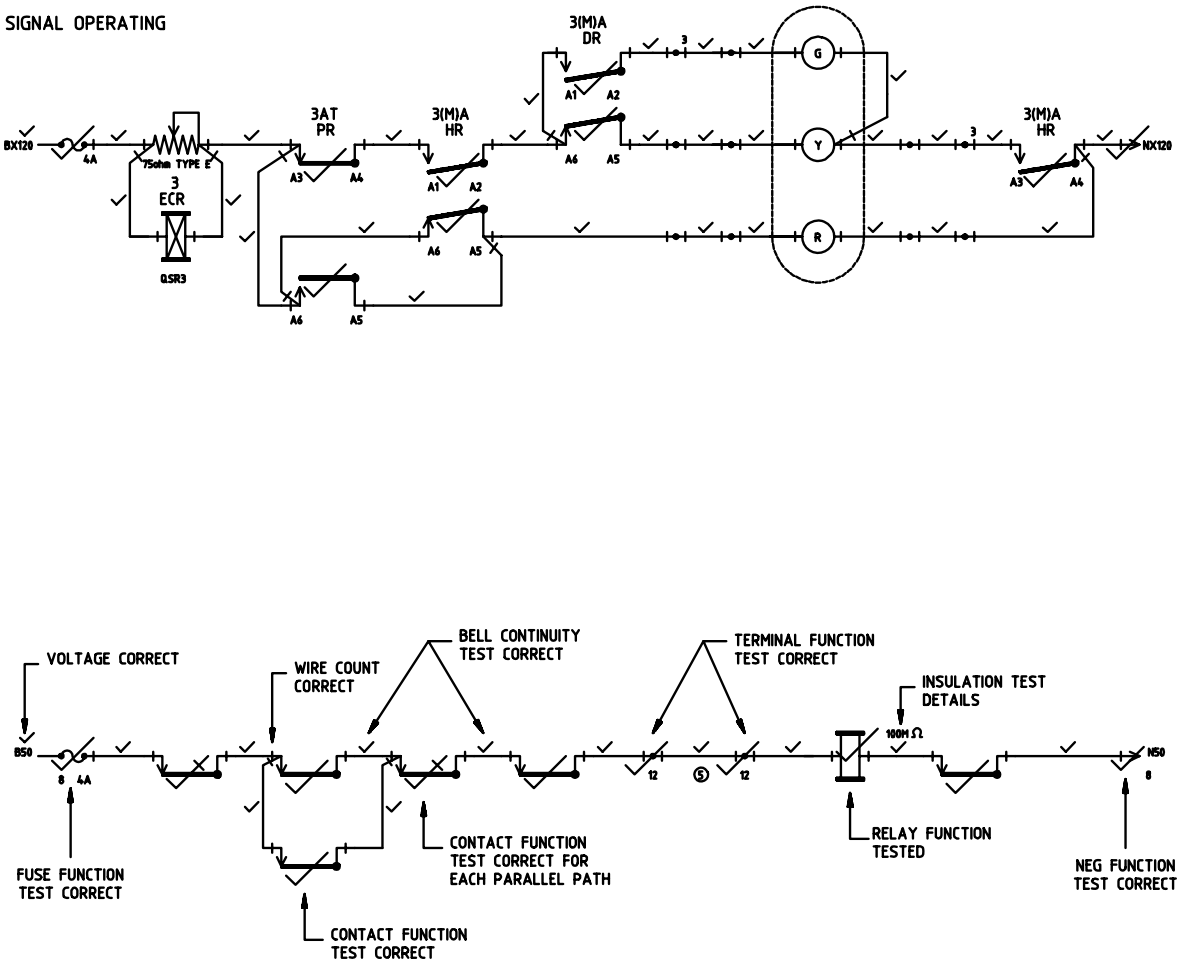
Function test denoted by large tick	✓
Through testing of contacts (eg. tracks in auto signals) denoted by T symbol	T
Aspect check denoted by large tick	✓

3.12.4 RECORDED ON CIRCUIT BOOK SHEETS

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

3.12.5 RECORDED ON TRACK AND INSULATION PLANS

Inspection denoted by large tick against item checked eg. signal, track circuit limit,	✓



SHEET FULLY TESTED → ✓ S Officer

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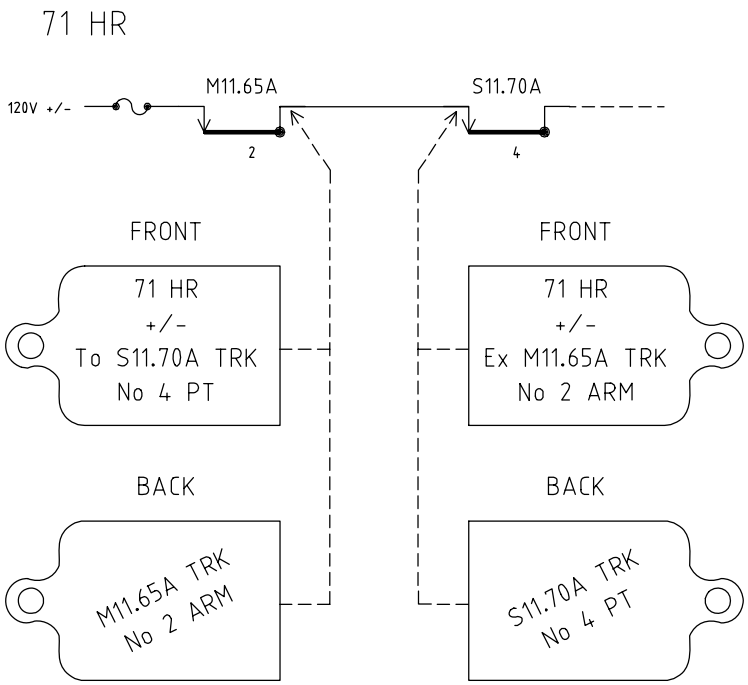
EXAMPLE OF PAPER TAG IDENTIFICATION LABELS FOR WIRES



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3.7 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.

3.7.1 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.

3.7.2 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.

3.7.3 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.

3.8 Certification and Design Integrity Testing Documentation

At the completion of design integrity testing the design engineer provides the Commissioning manager a copy the signed off the 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 Manager Standards.

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 ARTC 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 ARTC polices 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 Interface Agreement and Interface Coordination Plan in accordance with ESC-21-03 Inspection and Testing of Signalling - Inspection and Testing Principles,
- 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 ARTC Quality Management System.

Further, construction design documents in accordance with ARTC standards and procedures 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,
- Signal Sighting Forms,
- Installation Drawings,
- Equipment Housing Layout Plans,
- Mechanical Drawings,
- Structures and Buildings,
- Clearance Diagrams,
- Level Crossing Layout Plans,
- Safe Notice and Train Notices,

All the above documents and electronic copies of the documents shall be updated to “as built”, electronic and 6 hard copies provided to the Regional representative 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.

ESC-21-04 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 ARTC Engineering (Signalling) Standards 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 ARTC standards and procedures 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, implementation then work as executed documentation:

- 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, track circuit limits, foundations, cable routes, under-track crossings and all like work.
- The installation drawing/s detailing each site construction layout shall be nominated throughout the drawings.

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,, points, catch points, insulated rail joints, 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

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

- The location of all cable 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 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 ARTC land are to be shown,

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.

4.2.1.2 File Format

Where suitable mapping files are available, they may be used as a basis for D.S.S's converted to .dwg files. Current Versions of AutoCad and AutoCad Lite are preferred however, any well supported, reliable drafting software may be used which can save or export files in ". dxf" format which can be opened and edited by current versions of AutoCad, or which can save in a ".dwg" format that can be opened and edited by the current Version of AutoCad and AutoCad Lite.

4.3 Construction Photography – General Requirements

The Site manager 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 on the disc 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 e.g. 100 metres of trench,
- Prior to being covered up including foundations and trenches.
- General progress and good workmanship,
- 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 manager shall be responsible for the production of the Commissioning Notices.

The commissioning notice forms part of the Commissioning Work Package that is defined in this Standard.

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, Train Notice.
3) Isolations details
   - Power off permit - details and arrangements.
4) Commissioning headquarters
   - Location, telephone numbers, names and contacts details of Commissioning and Deputy commissioning manager/s.
5) Accreditation and competency statement
   - Personnel to carry out duties only within the bounds of their accreditation.
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 manager.
   - 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.
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
   - Instructions for track circuit teams, reporting when each track is certified, communications arrangements for correspondence testing to design engineer at 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 (eg. 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) Occupational 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.

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 ARTC 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 the Infrastructure Operations Centre.

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 – Safe Notice or Train Notice

The Commissioning manager shall liaise with the Regional representative to ensure that full detail of all alterations is advertised with at least one weeks notice in the Safe Notice.

Note: 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 Safe Notice or Train 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 Engineering Standards, Procedures and the Network Procedures.

6 Equipment Registers

6.1 Responsibility

Maintenance of the ARTC Ellipse 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 Manager

Spreadsheets nominating new equipment commissioned shall be provided by the Commissioning manager when specifically nominated and agreed in the Project Work Interface Agreement. The Regional signal representative shall provide the required spreadsheet nominating all required fields at the time of agreement. A Draft Asset Register shall be issued 1 week prior to Commissioning start.

7 Works and Inspection, Testing & Commissioning Programs

7.1 Summary and Detailed Works Programs

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

Sub-networks shall be produced for the Inspection and Testing and Signalling Safeworking requirements including Stage work, Temporary work, Worksite protection and Possession activities. The Commissioning manager may delegate these tasks to Site managers and Team leaders 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 Safe Notice or Train Notice requirements to Regional representative 9 weeks from commissioning,
- Agreed track possessions.

7.2 Program for Signalling Safeworking, Inspection, Testing, and Commissioning

The Project manager shall prepare a Signalling Safeworking, Inspection, Testing, and Commissioning Program as part of the Inspection and Testing Plan and as a detailed sub network to the Works Program.

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

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 Standards, Project Work Interface Agreement, 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, Train control and telecommunications systems, Sub - contractor and third party 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 ARTC Engineering (Signalling) Standard ESC-21-03 Inspection and Testing of Signalling - Inspection and Testing Principles 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 manager and the Regional signal representative.

8.2 Notification of Inspections and Tests

Where the Tester in Charge is not the Commissioning manager, the Commissioning manager 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.

8.3 Commissioning Managers Review of Inspection and Testing Plan

Where the Tester in Charge is not the Commissioning manager, The Tester in Charge shall submit each of the three stages (Strategy, Outline, Detail) of the Inspection and Testing Plan for review to the Commissioning manager. 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 manager 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.

8.4 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 clause 11.

The Inspection and Testing Plan shall be formulated and prepared by the Commissioning manager in staged parts in accordance with the format below and utilising forms from ESC-21-04 Inspection and Testing of Signalling - Standard Forms.

Inspection and Testing Plans shall be approved by the Project manager or the Commissioning manager where the Tester in Charge is not the Commissioning manager.

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, Manuals, Guidelines or Instructions the actual requirements shall be determined by the Manager Standards.

For Computer Based Interlocking system requirements refer to respective standards and procedures and the manufacturers recommendations.

The end requirement of the process is to produce work instructions that are comprehensive and specific to the actual requirements. ESC-21-04 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 typical requirements. Where a database is used to assist in the production of typical documentation, the Commissioning manager shall be responsible to review, update, tailor and add any new or modified activities / tasks required to comply with the ARTC Engineering (Signalling) Standards, the actual systems, equipment, interfaces and stage work.

8.5 Identification

1) Project Description
2) Register Number
3) Version number and date

8.6 Parts

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

- **Part 1** Inspection and Testing Strategy
- **Part 2** Inspection and Testing Outline Plan(s)
- **Part 3** Inspection and Testing Detailed Plan(s)

8.7 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.

1) Implementation strategy for the works e.g. on and off site work, operational restrictions and requirements. Identify all third party and internal interface work to be coordinated. Power on dates for new supplies and temporary power requirements
2) Strategy for inspection and testing for safety certification and quality assurance aligned with the implementation strategy for the works.
3) 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 Standards and set the hold points required, e.g. services searches, circuit correlation checking and testing, cable routes, Under Line Crossing (U.L.X's), cables, structures, foundations, formwork, earth mats and off-site work.
4) Identification of inspection and testing requirements for interface and stage work
5) Scope, methodologies and access limitations for inspection and testing of interface work
6) Scope, methodologies and responsibilities at Commissioning, Locking and Design Integrity Testing requirements,
7) Practices to be used to confirm the condition of any existing systems to be modified eg provisions of the Interface coordination plan, design correlation check
8) Provisions for signalling safeworking, relocating or removing existing signalling
9) 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 and removal of "X" boards on signals, Safe Notice/Train Notice.

10) Possession and Worksite Protection requirements for inspection and testing.

11) Inspection and testing personnel requirements

12) Organisation Chart for the inspection and testing program

13) Access requirements and restrictions.

- List of any special access requirements to the ARTC site for conducting inspections and tests.

14) Co-ordination with other works eg. Track, civil, electrical (power & OHW), train control, wayside systems and telecommunications.

- Procedure for identifying other works, liaison with responsible parties, and identification of responsibilities for the Coordination activities.

15) 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

16) Training and accreditation requirements for inspection and testing personnel

17) Special Considerations

18) 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 waivers required
- Environmental hazards and management of their risk
- Occupational Health and Safety issues.

19) The Inspection and Testing Strategy Matrix checklist form included in ESC-21-04 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.

8.8 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 ESC-21-04 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 follows:

8.8.1 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.

8.8.2 System / 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.

8.8.3 Certified By

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

8.8.4 Certification Documents

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

8.8.5 Standards and Procedures

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

8.8.6 Time

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

8.9 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 Procedures Manual" eg. Bridging Authorities, Damage to Signalling Equipment, Booking Out and Disconnection of Signalling Apparatus, Testing of Interlockings, Track Circuits, Rerailing, Traction Return, FPL and Detection testing, Security locking and keys, Waivers, Signalling related risk assessments – Electrical, Mechanical et cetera,
- The installation, maintenance and removal of cross boards or bags 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, 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 Forms. The installation of signals shall be certified to comply with the agreed Signal Sighting 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, Eg. Lists of locations, relay rooms, cable routes, points, signals, track circuits, track circuits, 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 ESC-21-04 Inspection and Testing of Signalling - Standard Forms:

Description of inspection and testing and Signalling Safeworking activities as nominated in the Engineering (Signalling) Standards - Construction, the Inspection and Testing of Signalling Standards and Signalling 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.
- 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 Site manager/Project Managers 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. Specification ESC-21-04 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 (Clause 8)
- Installation Work Package (Clause 9.2)
- Commissioning Work Package (Clause 9.8)
- Handover Documentation Package (Clause 10)

For *Minor signalling work* that complies with the definition at Clause 1.3 included in this Standard and agreed with the Regional signal representative:

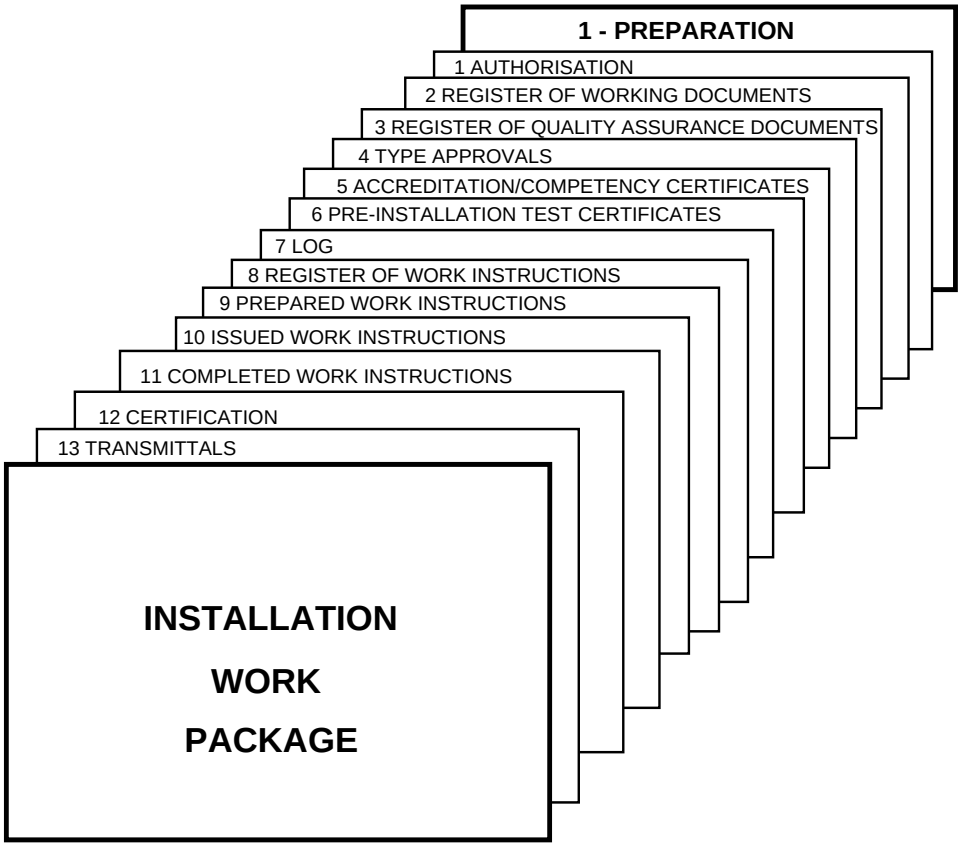
- Minor Work Package (Clause 11)

Each work package shall be registered with a discrete Work Package Number provided by the Tester in Charge 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.

Submit each work package, when prepared and approved by the Commissioning manager, for review and approval in principle by the Regional signal representative.

9.2 Installation Work Package 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-networks, Inspection and Testing Plan for the works, 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 ARTC Engineering (Signalling) Standards.

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 manager 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 and described as follows; the referenced forms are found in ESC-21-04 Inspection and Testing of Signalling - Standard Forms.

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* as defined in Clause 1.3 may be documented as set out in Clause 11 of this Standard.

9.2.4 Responsibility

9.2.4.1 Management, Engineering and Construction Personnel

For Project manager, Regional signal representative, Commissioning managers, Team managers, Site managers and Work Group leaders - refer to ESC-21-01 Inspection and Testing of Signalling – Roles, Responsibilities and Authorities.

9.2.4.2 Team Leaders

Responsible for performing the work to the ARTC Standards, Manuals and Instructions and as delegated by the Commissioning manager, Site manager and Work group leaders. Managing the work team/s. 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 Definitions

Installation Period

The Installation period commences with the issue of “Approved for Construction” design, approval of any Signal Sighting Forms, Detailed Site Surveys and the completion of Services searches and ends with the completion of the Inspection and Testing Status Certificate.

Pre-Commissioning Period

The Pre-commissioning period coincides with the preparation phase of the Commissioning Work Package and ends when the Commissioning Period starts.

Commissioning Period

The Commissioning period starts when the existing equipment is "booked out of use" and ends when the new or altered works are "brought into use".

Post-Commissioning Period

The Post-Commissioning Period starts when the Commissioning Period finishes and ends with the Post-Commissioning meeting.

Activity

An Activity is defined by the following:

1) A stand-alone unit of work.
2) Work required on a piece of equipment or apparatus that is individually numbered or that is identified on a working drawing.
3) Equipment brought into use or taken out of use.
4) Testing as set out in standards and procedures.
5) Safeworking and Signalling Safeworking requirements.
6) Documentation requirement.

Task

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

Authorising Officer

The Site manager during the Installation Phase.

9.2.6 Associated procedures

Procedure for Preparation of Commissioning Work Package

Procedure for Implementation of Commissioning Work Package

Procedure for Evaluation of Commissioning Work Package

9.2.7 Procedure for Preparation of Installation Work Package

1) **Authorisation of Package**

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 "SUPERCEDED" in the Register, and include the following;

Construction Copies of Working Drawings including:

- Circuit Book
- Signalling Plan
- Signalling / Track Plan
- Track Insulation / Bonding Plan

  Locking Table
- Locking Diagram
- Signal Sighting Forms
- Site Installation Drawings
  - Mechanical
  - Level Crossing Layout
  - Structure and Building
  - Clearance diagram
  - Equipment Layout
  - Equipment Design
  - Modifications

Sign off that all "as built" drawings are included in the Handover Documentation Package.

Register of Detailed Site Survey Plans

Register of Equipment and Operating Manuals

Register of Test Copies of Working Drawings

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) eg. references Detailed Site Survey, Signalling Construction Standards, etc
- Acceptance of manufactured and/or installed equipment
- Manufacturer's inspection and testing certificates
- Off site inspection and testing certificates eg., Pre-site test certificate
- On site inspection and testing certificates

- Ready for Test Certificates

4) **Type Approvals Specific for Project**
   - Include all project specific approvals from the Manager Standards
   - Include any Waivers granted by the Manager Standards
5) **Accreditation/Competency Certificates- copies of Statements of Competencies for all staff**
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.
7) **Installation Log and Site Photography.**
8) **Register of Installation Work Instructions**
9) **Prepared Installation Work Instructions**
10) **Issued Installation Work Instructions**
11) **Completed Installation Work Instructions**
12) **Certification of Installation Work Package**
   - The Installation Work Package is signed off 2 weeks before the commissioning to enable review of the Commissioning Work Package. Installation Status Certificates are completed and signed off.
   - This also includes variations to the Inspection and Testing Plan and approved waivers to Standards.
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.

9.2.8 Procedure for the implementation of the Installation Work Package

9.2.8.1 General

Implement and update the plan to reflect progress of the work and any changes. The Implementation Plan and its records are critical inputs to the Commissioning work Package. The information shall be kept updated during its implementation.

9.2.8.2 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 ESC-21-04 Inspection and Testing of Signalling - Standard Forms for the required form.

The Site manager, Tester In Charge, or Commissioning manager 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 manager 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 manager.

9.4 Reporting Defects and Irregularities Found

Site personnel and Test engineers shall promptly report to the Commissioning manager all defects and irregularities found during or after installation and certification inspection and testing. Investigate and establish the cause of the defect or irregularity.

Submit the proposed action to rectify the defect or irregularity to the Commissioning manager for review and permission to proceed.

The nature of the defect or irregularity 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 in ESC-21-04 Standard Forms, for obtaining the permission of the Commissioning manager.

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 manager, recorded in detail, and fully investigated and corrective action taken to the satisfaction of the Commissioning manager.

9.5 Installation Inspection and Testing Status Certificate

An Installation Inspection and Testing Status Certificate (see ESC-21-04 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 manager 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 lists any approved variations to the Inspection and Testing Plan or waivers to standards or procedures.

9.6 Commissioning the Works

9.6.1 General Requirements

The Commissioning manager shall prepare plans, programs, and work packages for the commissioning of the Works. The Commissioning manager shall coordinate, direct and control the implementation of the commissioning stage 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 ARTC 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 ARTC fatigue management system including a maximum ten (10) working hours for personnel engaged in safety related work. Rosters and procedures shall comply with all relevant Occupational Health and Safety legislation and Regulations.

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.

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 shut down 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 ARTC standards and procedures 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 manager 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 manager 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. Train staffs, Annett keys and locks, "Fortress" keys (on ESML or EOL systems) and locks shall be handed to the Commissioning manager and a receipt obtained.

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 History Cards, plans, drawings, manuals and handbooks are to be provided to the Regional signal representative for distribution to maintenance personnel. Where any modification has been necessary during the commissioning, these changes shall be marked up and identified by the Modification Form number applicable. History cards may be places in the respective locations.

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

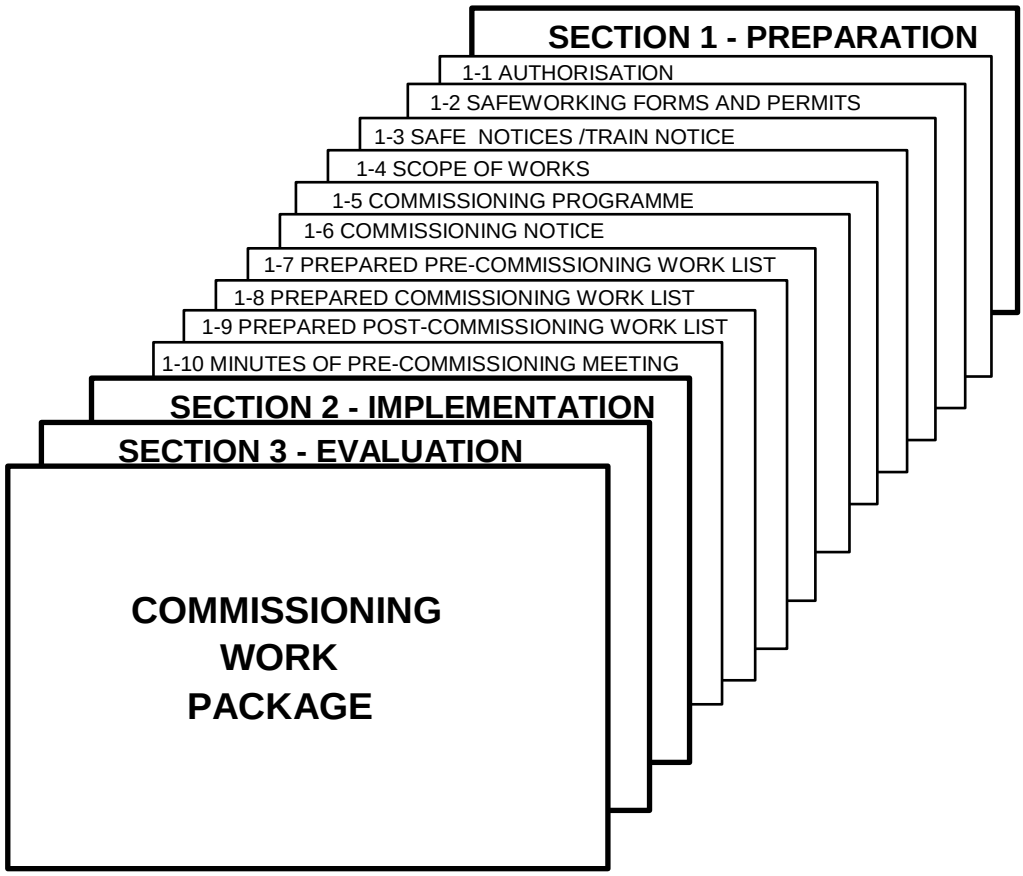
Prepare a Commissioning Work Package for the commissioning of the works, or each phase, section or stage of the works as identified in the Works Program.

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 ESC-21-04 Inspection and Testing of Signalling - Standard Forms. The contents of the Commissioning Work Package are set out as follows:

Section 1 – Preparation	Reference
Authorisation	1-1
Safeworking Forms and Permits	1-2
Safe Notice or Train Notice	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	**Reference**
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	**Reference**
Commissioning Certificate	3-1
Commissioning Log	3-2
Attendance Book	3-3
Report of Post-commissioning Meeting	3-4
Transmittals	3-5

9.9 Commissioning Work Package - Phase 1 Preparation Before Commissioning



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 Works that comply with the definition *of minor signalling work* as defined in Clause 1.3 may be documented as set out in Clause 11 of this Standard.

9.9.4 Responsibility

9.9.4.1 Management, Engineering and Construction Personnel

For Tester in Charge, Regional signal representative, Commissioning manager, Team managers, Site managers and Work Group leaders - refer to ESC-21-01 Inspection and Testing of Signalling – Roles, Responsibilities and Authorities.

9.9.4.2 Deputy Commissioning Manager/s.

Assist the Commissioning manager 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 Interface Agreement, 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 ARTC Standards, Manuals and Instructions and for performing the work as delegated by the Commissioning manager and/or detailed on the Pre-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.

9.9.5 Definitions

Commissioning

Commissioning is that stage of the works where there is the bringing into use of any new and altered Signalling, interface or stage works.

Pre-Commissioning Period

The Pre-Commissioning Period coincides with the preparation phase of the Commissioning Work Package and ends when the Commissioning Period starts.

Commissioning Period

The Commissioning Period starts when the existing equipment is "booked out of use" and ends when the new or altered works are "brought into use".

Post-Commissioning Period

The Post-Commissioning Period starts when the Commissioning Period finishes and ends with the Post-Commissioning meeting.

Activity

An Activity is defined by the following:

1) A stand-alone unit of work.
2) Work required on a piece of equipment or apparatus that is individually numbered or that is identified on a working drawing.
3) Equipment brought into use or taken out of use.
4) Testing as set out in Standards and Procedures.
5) Safeworking and Signalling Safeworking requirements.
6) Documentation requirements.

Task

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

Authorising Officer

The Commissioning manager (and / or Deputy Commissioning manager/s during the Commissioning phase).

9.9.6 Associated Procedures

Procedure for Implementation of Commissioning Work Package

Procedure for Evaluation of Commissioning Work Package

9.9.7 Procedure for Preparation of Work Package

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 manager analyses the risk associated with the proposed works to ensure that it is compatible with the commissioning. Generally, works that involve on track plant, work trains, affects power supplies, track circuits or points during the design testing phase would not be compatible. The Commissioning manager 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".

Pre-Commissioning Conference

The Commissioning manager arranges the pre-commissioning conference in accordance with the procedure for this activity 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.

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 has a number that is recorded in a register 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.

A sturdy A4 sized PVC binder with four "D" shaped ring binders is utilised to contain the Commissioning Work Package.

Preparation of Safe Notice / Train Notice

The Project manager initiates via the Regional representative for design to arrange the publication of the Safe Notice/Train Notice for the agreed dates. The Regional representative provides draft copies of the write up for the weekly notice and drivers diagram insert, and/or circular to the Project manager for comment. Copies of the request and progressive issues of the documents are inserted in Section 1-3 of the Commissioning Work Package.

Communications - Radio and Telephone Systems

The Commissioning manager 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.

Scope of Works

The Commissioning manager 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:

1) Pre-Commissioning period activities
2) Commissioning period activities
3) 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:

1) Circuit Book
2) Track Plan
3) Signal Arrangement Plan
4) Track Circuit Bonding Plan
5) Locking Table
6) Locking Diagram
7) Lever Nameplates
8) Detailed Cable Plan
9) Detailed Site Survey Drawing
10) Signal Sighting Form
11) 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 manager to update and sign the Certified Commissioning Copy in the Post Commissioning period. Eg, Working drawings issued with Commissioning work instructions to be marked up signed and certified as a record of inspection and testing; senior signal engineer to verify the Signalling Plan, Track Insulation Plan and Signal Sighting 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, Inspection and Testing Plan for any integrated systems (Train Control and/or Telecommunications systems, 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 manager are inserted into Section 1-4 of the Commissioning Work Package.

The Commissioning manager completes the form, “Safeworking Forms and Permits”, checks, and signs the form. If a “1500 Volt Overhead Wiring Permit to Work” is required, the Commissioning manager prepares the associated personnel register. The Commissioning manager 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.

Management and Team Structure

The Commissioning manager formulates 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.

Identification of Teams

The Commissioning manager identifies the teams that will be required.

The Commissioning manager nominates the level of 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.

Preparation of Commissioning Program

The Commissioning manager 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,
- Train Control and/or Telecommunications systems 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.

Preparation of Draft Commissioning Notice

The Commissioning manager 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.

Review of Commissioning Work Package

The Commissioning manager, Deputy commissioning manager/s, 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 manager 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.

Preparation of Work Instructions

The Commissioning manager documents all applicable commissioning activities onto work instructions using a standard form.

Work Instructions fall into three categories:

1) Pre-Commissioning
2) Commissioning
3) 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.

Engineering (Signalling) Standard ESC-21-04 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 Standards, Guidelines, Maintenance Manuals, Manufacturer's and Signal Engineering Instructions. Activities and Tasks shall be written using the terminology and context used in the ARTC Engineering (Signalling) Standards 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 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 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 Team leader to verify with the commissioning headquarters that a previous activity has been completed.

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.

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

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.

Preparation of Staffing Details

For each planned activity, the Commissioning manager nominates the team structure and individual competency requirements to the Tester in Charge. The Tester in Charge in consultation with the Team manager and Commissioning manager arranges to allocate appropriate specific personnel to fulfil the program, competency and team structure requirements.

The Plan should include a list of all the staff and their competencies to assist in the reallocation of tasks if required.

All personnel in the management and team structure from the Commissioning manager to the level of Team leader conducting Signalling Safeworking, inspection and testing responsibilities shall to be in possession of a current "Statement of Competency". If applicable a copy of the Project managers advice regarding any "work under supervision" restrictions are inserted in Section 1-6 of the Commissioning Work Package. Appropriate supervision may be provided to allow individuals to gain experience where their competency statement requires them to "work under supervision" for the required task.

The Commissioning manager documents staffing details on the commissioning roster. The roster is inserted into Section 1-6 of the Commissioning Work Package.

When preparing the roster, the Project manager, Team manager and Commissioning manager are to consider the ARTC policy and procedures for fatigue management.

Preparation of Final Commissioning Notice

The Commissioning manager 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 Standard.

The Commissioning manager e-mails a copy of the notice to the Infrastructure Operations Centre (O.I.C.).

Publication of Operations Documents

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

Pre-Commissioning Conference and Meeting

The Commissioning manager to arrange meetings as follows: Signalling Commissionings will be divided into two types Large Commissionings >48 hours and small Commissionings <48 hours. For Large Commissionings meetings will be held 28 days prior to commissioning and then 8 day prior and determined on A Go No Go basis. Smaller Commissionings will have a Commissioning meeting 14 days prior to Commissioning and then 8 day prior determined on a Go No Go basis.. The Commissioning manager and Project manager attends along with representatives of other engineering, integrated systems (Train control and/or Telecommunications systems), 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 manager, 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 are required to 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 a Team leader cannot attend the pre-commissioning meeting (allowed only in special circumstances), The required notices and work instructions are forwarded to the Team leader who then arranges to visit site as above. The Commissioning manager arranges for the Team leader to be inducted/briefed before the Team leader starts work and retains a record of the briefing.

The Commissioning manager also ensures that representatives of other groups working within the commissioning area attend the pre-commissioning meeting. If this is not possible, the Commissioning manager (or delegate) inducts and briefs these representatives before they start work, and retains a record of the briefing.

The Commissioning manager records attendance for the meeting, prepares minutes of both meetings, and distributes them to those present and any other parties referred to in the minutes. A copy of each set of minutes and attendance list for the meeting is inserted in Section 1-10 of the Commissioning Work Package.

This 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 meetings.

Asset Register

As agreed in the Interface Coordination Plan, at least two weeks before the commissioning, the Commissioning manager delivers details of the asset changes to the Regional signal representative. Updates are provided by the Commissioning manager for amendments in the pre / commissioning periods. A copy is inserted into the Handover Documentation Package.

Authorisation of Commissioning Work Package

The Commissioning manager and the Regional signal representative 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.Work packages are to be signed off prior to the Go-No Go meeting.

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

Pre-Commissioning Work Instructions

The Commissioning manager 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 manager 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 manager 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 manager reviews the uncompleted tasks with the Team leader and determines the appropriate actions required.

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

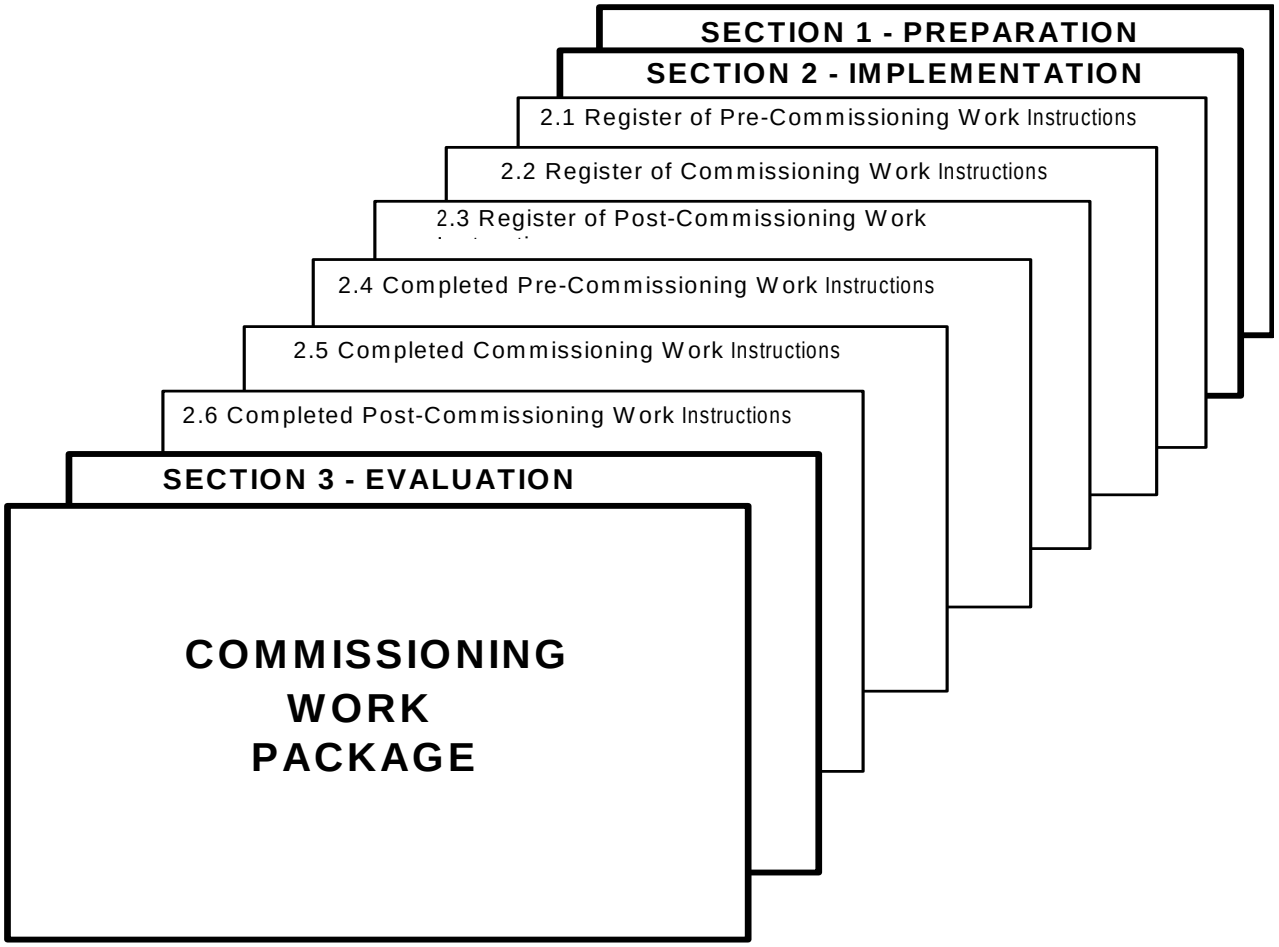
Completed Pre Commissioning Work Instructions are inserted into Section 2 of the Work Package.

To enable a particular Pre Commissioning Work Instruction to be signed off, uncompleted 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 manager 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.

9.10 Commissioning Work Package – Phase 2 Implementation During Commissioning



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.

Exception Works that comply with the definition of *minor signalling work* as defined in Clause 1.3 may be documented as set out Clause 11 of this Standard.

9.10.4 Responsibility

9.10.4.1 Management, Engineering and Construction Personnel

For Project manager, Regional signal representative, Commissioning manager, Team managers, Site managers and Work Group leaders - refer to ESC-21-01 Inspection and Testing of Signalling – Roles, Responsibilities and Authorities.

9.10.4.2 Assistant Commissioning Manager/s

Fulfil the role of Commissioning manager during absences of the Commissioning manager; 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 t finishing the shift.

9.10.4.3 Team Leaders

Responsible for performing the work to the ARTC Standards, Manuals and Instructions and performing the work as delegated by the Commissioning manager 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 manager 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 manager 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, outstanding actions to the Commissioning manager. Following each shift changeover, the work package controller prepares the returned work instructions and work instruction register for the Commissioning manager 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 Definitions

Refer to Clause 9.9.5

9.10.6 Associated Procedures

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

9.10.7 Procedure For Implementation Of Work Package

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.

Each person signing on for their shift with personnel identification nametags coded for restricted access to particular locations around the Commissioning site.

Issue of Commissioning Work Instructions

Each Team leader reports to the Commissioning manager or work package controller at the Commissioning headquarters.

The Team leader is issued with the applicable prepared 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 Track circuit set to work and test and certify forms, Track History Cards.

When required the Commissioning manager gives the Team leaders any final instructions and the Team leaders clarify with the Commissioning manager any uncertainties they may have concerning the work instruction/s.

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 manager signs off any new Work Instruction prior to issue for implementation and includes it in the register.

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

Commissioning Log

The Commissioning manager opens the Commissioning Log. The first entry is made from the time that the first shift signs on for duty.

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

The Commissioning manager closes the Commissioning Log.

All activities and events not covered by Work Instructions are to be entered into the Log by the Commissioning manager. 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 eg. reports of activities associated with “Booking out or into use” and the use of bridging authorities,
- Progress reports from Team leaders,
- Reports of potential delays,
- Details of defective equipment including new and old serial numbers,
- Possession issues referred to the Regional signal representative,
- Progress reports from “other works”, Train Control and Telecommunications systems,
- Incidents and/or near misses,
- Environmental incidents and escalation details,
- Complaints from the public and method of resolution,

The Commissioning manager 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.

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.

Report on Progress

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

Report Problems

Team leaders promptly report any problems encountered to Commissioning Headquarters.

Monitor Progress

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

Exception activities are reported in the Log.

A Signalling Plan is used to mark up 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.

Communications Systems

The delegated Site manager/Work group leader provides technical support including management of batteries during the Commissioning.

Prepare, Register and Issue New Work Instructions

Modifications, incomplete work instructions or documentation, Log items, defective equipment, changing Signalling Safeworking requirements etc shall be managed by the issue new Commissioning or if required, Post Commissioning Work Instructions. For uncompleted tasks the Commissioning manager shall review the circumstances with the Team leader and where required they are prepared, authorised, issued and recorded in the Register of Work Instructions by the Commissioning manager.

The Commissioning manager registers all new commissioning or Post-Commissioning Work Instructions.

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

Complete and Return Work Instructions

Team leaders complete their Work Instructions and note any uncompleted 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 manager (or if instructed the Work package controller) at the Commissioning Headquarters with their Work Instructions and all associated documents and records.

Receive, Check, Action Returned Work Instructions

The Commissioning manager 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 manager 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.

Transfer Incomplete Tasks to New Work Instructions

Only when all tasks on a Work Instruction are completed satisfactorily does the Commissioning manager sign the "Received, Checked, Action" statement. To enable a particular Work Instruction to be signed off, the Commissioning manager transfers uncompleted task to new

Commissioning or Post-Commissioning Work Instruction(s). This fact is noted on the Work Instruction from whom they were transferred.

New or transferred Work Instructions are to be registered and authorised by the Commissioning manager 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 manager.

File completed Commissioning Work Instructions

The Commissioning manager 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.

Signing Off Duty

Team leaders complete their duties only after all the Work Instructions for whom the applicable Team is responsible have been signed off as received, checked and actioned.

The Commissioning manager then releases the Team leader; the Team leader and the team sign off duty.

Signing into use the New and Altered Signalling

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

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

The Commissioning manager determines that the inspection and testing, Signalling Safeworking, Design Integrity, integrated Train control / Telecommunications system testing and certifications are complete notes this in the status column and signs that item. Exceptions, Work Instructions cancelled or transferred to the Post-Commissioning period shall be specifically noted.

The Commissioning manager checks all required "Mechanical/Relay Locking Test Certificate SF S4.304A/B" and/or "Design Integrity / Control table Function Test Certificate SF S4.304C" from the design integrity Team leader and inserts copies into Section 1-2 of Work Package.

The Commissioning manager determines the status of:

- Type approvals,
- Issued design documents, lists each and notes individual status,
- Lists of modifications and notes each individual status,
- Track circuit master sheets, History cards complete and ready for delivery to site,
- Test and Certify Forms (TC) complete
- CBI Certifications complete,
- Train Control and Telecommunications system certifications,
- Exceptions - list any work not to be Commissioned etc.

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

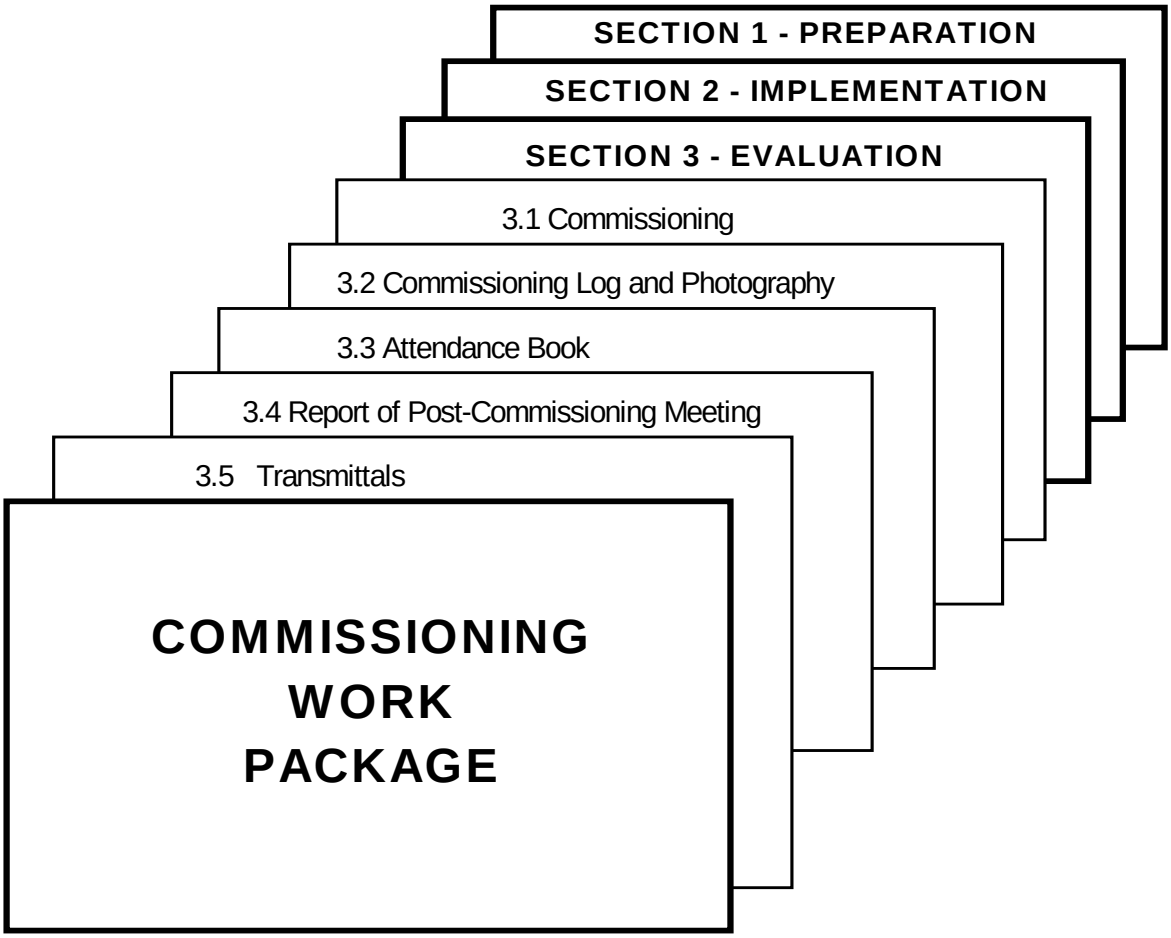
The Commissioning manager liaises verbally with the Signaller and other disciplines ensuring that all required Certifications have been provided i.e. Track, Civil, Electrical and/or Overhead Wiring have signed the Infrastructure Booking Authority form.

The Commissioning manager, 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 manager arranges removal of Signal "X boards" and protection and signs the equipment into use in accordance with the Network Rules and Procedures.

The Commissioning Manager notifies the Network Controller that the infrastructure has been booked into service.

9.11 Commissioning Work Package – Phase 3 Evaluation



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.

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 manager, Team managers, Site managers and Work Group leaders - refer to ESC-21-01 Inspection and Testing of Signalling – Roles, Responsibilities and Authorities.

9.11.4.2 Team Leaders

Responsible for performing the work to the ARTC 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 Definitions

Refer to Clause 9.9.5

9.11.6 Associated Procedures

- Procedure for Preparation of Commissioning Work Package
- Procedure for Implementation of Commissioning Work Package

9.11.7 Procedure For Evaluation Of Work Package

Safeworking Forms and Permits

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

The Commissioning utilises the Checklist in Section 1-2 to ensure that all Forms; Permits and records are included.

Check Commissioning Log and Photography

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

To assist in the completion of these activities, where appropriate, an uncompleted activity is transferred to a new Post-Commissioning Work Instruction. Details are noted in the Commissioning Log.

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

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

Attendance Book

The Commissioning manager inserts a copy of the Attendance Book, Attendees list and Roles/duties of staff for the commissioning into Section 3-3.

Post-Commissioning Work Instructions

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

The Commissioning manager 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 on the Register.

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

When the Team leaders return their Work Instructions, the Commissioning manager 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 manager 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 manager 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.

Review of Work Status

The Commissioning manager 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.

Post Commissioning Meeting

Within two weeks of the end of the Commissioning Period, the Commissioning manager 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 manager/s, Site manager and Work group leaders, Work package controllers and any other key personnel identified by the Commissioning manager.

The Commissioning manager prepares the 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.

Delivery of Work Package

If agreed as part of the Project Work Interface Agreement the Commissioning Manager delivers a copy of the completed Commissioning Work Package/s to the Regional signal representative.

This is done under cover of a Document Transmittal signed by Regional signal representative and a signed receipt acknowledgment is obtained.

Storage of Work Package

Within 4 weeks of the end of the commissioning period, the Commissioning manager delivers the originals of the Inspection and Testing Plan, Installation Work Package, Commissioning Work Package/s to the Project manager who arranges to update the project registration database and archive the originals in accordance with the current processes and practices.

The Project manager arranges to update the Project Documentation Register accordingly.

Storage of Test Copies of Design Documents

Within 4 weeks of the end of the commissioning period, the Commissioning manager delivers the originals of Master Testing Copy, design documents used for inspection and testing of the Works to the Project manager who arranges to register and archive the originals in accordance with the current processes and practices.

10 Handover Package

The Commissioning manager shall hand over to the Regional signal representative 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 Eg, Detailed Site Survey Drawings, Signal Sighting Forms, Installation Drawings, Equipment Housing Layout Plans, Mechanical Drawings, Structures and Buildings, Clearance Diagrams, Level Crossing Layout Plans,
- Copies of any other documents required to be provided as agreed on the Project Work Interface Agreement.

The hand over package shall also include:

- Copy of Practical Completion Certificate
- Copy of Defects and Omissions Form

A copy of Final Certificate signed with the Commissioning manager when all known defects and omissions have been satisfactorily rectified and completed shall be provided and added to the package when available.

11 Minor Works Package

11.1 Purpose

New and altered signalling works that comply with the *Definitions* included at Clause 1.3 for *Minor signalling work* 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 the Commissioning manager have agreed as meeting the definition included in the *Definitions* Clause of this Standard. 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 Applicable Documents

ARTC Engineering (Signalling) Standards – Inspection and Testing of Signalling:

Signal Engineering Guidelines,

Signal Engineering Instructions,

Personnel training, accreditation and logbook documents.

ARTC Engineering (Signalling) Standards - Construction:

11.5 Responsibility

11.5.1 Management, Engineering and Construction Personnel

For Project manager, Regional signal representative, Commissioning manager, Team managers, Site managers and Work Group leaders - refer to ESC-21-01 Inspection and Testing of Signalling – Roles, Responsibilities and Authorities.

The Tester in Charge shall be the Commissioning manager for all works utilising a Minor works package.

11.5.2 Team Leader

Responsible for performing the work to the ARTC 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 manager 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 Definitions

11.6.1 Minor Works Package

Minor works package refers to a document that includes the elements of an Inspection and Testing Plan, Installation Work Package, Commissioning Work Package and Handover Documentation Package.

11.6.2 Activity

An Activity is defined by the following:

- A stand-alone unit of work.
- Work required on a piece of equipment or apparatus that is individually numbered or that is identified on a working drawing.
- Equipment brought into use or taken out of use.
- Testing as set out in standards and procedures.
- Safeworking and Signalling Safeworking requirements.
- Documentation requirement.

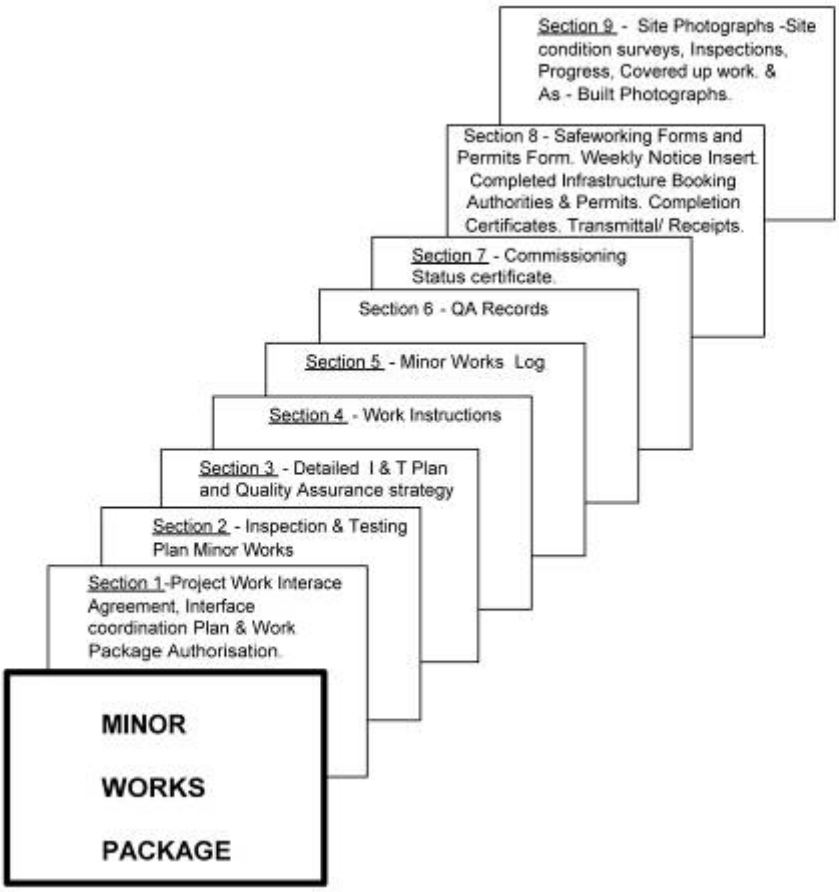
Task

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

Authorising Officer

The Commissioning manager.

11.7 Procedure



11.7.1 Preparing the Minor Works Package

The documents and forms referenced below can be found in ESC-21-04 Inspection and Testing of Signalling - Standard Forms.

Section 1

Project Works Interface Agreement **and Interface Coordination Plan and Work Package Authorisation are filed in this section.** – The Regional signal representative collaborates with the Commissioning manager to reach agreement for a Project Works Interface Agreement and an Interface Coordination Plan in accordance with ESC-21-03 Inspection and Testing Principles and Infrastructure Division requirements.

Minor Works Package - Authorisation" cover sheet - The Commissioning manager 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 Division responsible for the works and the location/s of the work.
- **Work Package Register Number –** This is the Registration number given to the Minor works package by the Project manager.
- **Project Work** Interface Agreement **Registration Number,** as issued by the Regional signal representative.
- **Approved Design Details -** This is a listing of the signal 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** – Refers to the Scope of Works document and Network Alteration Notice for the project
- **Prepared by: Commissioning Manager –** This is the name of the Commissioning Manager.
- **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 manager signs off the cover sheet under "Prepared By" and at least four 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 Interface Agreement and Interface Coordination Plan signs off under "Approved In Principle By". The timing shall be arranged to ensure agreement at least two weeks prior to the commencement of site work.

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,
- 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 Waivers, Electrical – mechanical and pneumatic risk assessments,
- Other requirements eg. 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.
- Waiver Requirements. List if any.

Section 3

Minor Works, Installation – Inspection – Testing / Commissioning Detailed Plan & Signalling Safeworking Requirements – The Commissioning manager 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 Standards set out the installation standards, inspection, pass / fail criteria for signalling work. The Commissioning manager 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.

Section 4

Work Instructions

The Commissioning manager 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.

Engineering (Signalling) Standard ESC-21-04 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 Standards, Guidelines, Maintenance Manuals, Manufacturer's and Signal Engineering Instructions. Activities and Tasks shall be written using the terminology and context used in the Standards 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 ESC-21-04 Inspection and Testing of Signalling – Standard Forms shall be attached to the Work instruction.

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, references the Standards/Procedures/Drawings applicable.

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

Colour coding, ie 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

Section 5

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

The Commissioning manager prepares the required Log sheets.

Section 6

The Commissioning manager may prepare a list of required records.

Section 7

The Commissioning manager prepares a standard Commissioning Certificate and inserts it into Section 6.

Section 8

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

The Commissioning manager inserts all Transmittals / Receipts for design into this Section.

Notification of the Works in Network Alteration Notice – Preparation of Network Alteration Notice

The Commissioning manager initiates via the Regional signal representative to arrange the publication of the network alteration notice and drivers diagram for the agreed dates. The Regional signal representative provides draft copies of the write up for the network alteration notice and drivers diagram insert, and/or circular to the Commissioning manager for comment.

Copies of the request and progressive issues of the documents are inserted in Section 8 of the Minor Works Package.

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

Section 9

The Commissioning manager arranges for appropriate digital photography of the site. The disc is progressively collated and inserted into Section 9. Separate folders on the disc 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 disc) to describe the location, apparatus, purpose, situation, and reasoning intended to be conveyed in the photographs.

11.7.2 Implementing the Minor Works Package.

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

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

Minor Works Log - Following the "Sign off" of the Minor Works Package the Commissioning manager opens the 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 manager, 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,
- 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 manager 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 manager closes the Log.

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

Quality Records - The Commissioning manager, 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.

11.7.3 Evaluation of the Minor Works Package

Prior to bringing into use the Commissioning manager:

- 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 manager completes the Commissioning Certificate using the standard form included ESC-21-04 Inspection and Testing of Signalling - Standard Forms.

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

C.C.C.'s and Interim Maintenance Copies – The Commissioning manager returns C.C.C.'s of working drawings (within 28 days) to the Regional signal representative and issues Interim Maintenance Copies of working drawings. This is done under cover of Memorandums of Document Exchange.

11.7.4 Handover

Handover requirements shall be in accordance with Clause 10 and documents inserted into Section 8 the Minor works package.

11.7.5 Storage of the Minor Works Package

Where required and agreed in the Interface Coordination Plan the Commissioning manager issues a copy of the Minor works package to the Regional signal representative.

As soon as practicable following completion of the works, the Commissioning manager arranges for the archiving of the original of the Minor works package in accordance with the directions of the Project manager, in accordance with relevant Divisional Procedures and Instructions.