

# Project Controls

## Master Specification

### PC-RW50 Inspection, Testing and Commissioning

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## PC-RW50 Inspection, Testing and Commissioning

### 1 General

- 1.1 This Part specifies the Requirements for the management of the inspection, testing and commissioning process. Refer also to PC-QA1 “Quality Management Requirements.”
- 1.2 The following documents are referenced in this Part:
- a) RSNL Rail Safety National Law (South Australia) Act 2012 and Regulations.
  - b) AS 9001 Quality Management Systems – Requirements.
  - c) PC-QA1 Quality Management Requirements.
  - d) PC-RW10 Railways Management Planning.
  - e) PC-RW60 Asset Management Handover.
  - f) PTS-AR-10-PM-GUD-00000098 Guidelines for Inspection, Testing and Commissioning of Assets for Rail Projects.
  - g) SG1-DOC-000452 Testing and Commissioning of Signalling Systems (Draft).

### Definitions

- 1.3 The following definitions apply to terms used in this Part:

Term	Definition
Component	Includes materials, plant and equipment.
CSTR	Contract Scope and Technical Requirements.
COTS	Commercial Off The Shelf.
FAT	Factory Acceptance Testing.
SAT	Site Acceptance Testing.
SIT	System Integration Testing.
Type Test	The testing applied to a single component which enables other identical components to be used without further Testing.

### 2 Contractor’s Responsibilities

- 2.1 The Contractor is responsible for the inspection, testing and commissioning in accordance with the requirements of this Part and CSTR.
- 2.2 The Contractor must:
- a) appoint a railway experienced and practicing professional engineer as the Chief Commissioning Engineer for the duration of the Contract. The Chief Commissioning Engineer is responsible for ensuring that inspection, testing and commissioning activities comply with the requirements of this Part. The Chief Commissioning Engineer must be supported by a team of experienced commissioning engineers and technicians;
  - b) establish, manage and co-ordinate the inspection, testing and commissioning principles, program, requirements and procedures;
  - c) co-operate fully with the Principal’s Representative who will take a support role throughout the inspection, testing and commissioning process;
  - d) manage the interfaces of its systems with other systems, the external railway networks and the external facility networks;
  - e) provide all necessary and appropriate assistance and co-operation to the Principal’s Representative during all phases of the inspection, testing and commissioning process;
  - f) implement the inspection, testing and commissioning requirements included in this Contract in accordance with principles defined in this Part; and

- g) take into account the rules, procedures, constraints and practices of the Principal's Representative in formulating and implementing the inspection, testing and commissioning process.

### 3 Inspection, Testing and Commissioning Management Plan – General Requirements

- 3.1 The Contractor must develop, implement and comply with the Inspection, Testing and Commissioning Management Plan which is suitable for demonstrating that the Works comply with the requirements of this Contract.
- 3.2 The Inspection, Testing and Commissioning Management Plan must:
  - a) describe the subcontractors and personnel undertaking inspection, testing and commissioning, including contract details, organisational structure, roles and responsibilities;
  - b) describe the training, qualifications and / or certification of competency required for personnel undertaking inspection, testing and commissioning;
  - c) provide details all Items and Systems that will be subject to inspection, testing and commissioning;
  - d) provide details of all test equipment and calibration requirements;
  - e) provide details of all processes / procedures to be used for testing and commissioning;
  - f) reference to requirements / standards / specification and acceptance criteria;
  - g) integrate all Inspection and Test Plans (ITPs);
  - h) provide details the appropriate parts of the Safety Management System (including how testing will be managed in a live rail environment and when the 25kV Overhead Wiring System is live); and
  - i) define the validation and QA process that provides confirmation that all Requirements are met.
- 3.3 The inspection, testing and commissioning plan must address “Whole of System” inspection, testing and commissioning requirements to ensure all of the interfaces have been managed to prevent any “Whole of System” failure. This is to ensure that track, signalling, communications, rolling stock, OHW and traction power systems function correctly together.
- 3.4 Submission of the Inspection, Testing and Commissioning Management Plan shall constitute a **Hold Point**. The Inspection, Testing and Commissioning Management Plan is a Controlled Document.
- 3.5 The Contract Program must identify the duration, critical path and interdependencies in relation to all inspection, testing and commissioning activities.
- 3.6 The Contractor must develop, implement, maintain and comply with Inspection and Test Plans (ITPs) so as to provide objective evidence of compliance with the requirements of this Contract. ITPs must be developed as standard proforma in accordance with PC-QA1 “Quality Management Requirements.”
- 3.7 Provision of each ITP shall constitute a **Hold Point**. Each ITP proforma is a Controlled Document.
- 3.8 The Contractor must maintain a register of ITPs and include it in the Inspection, Testing and Commissioning Management Plan.

### 4 Inspection, Testing And Commissioning Requirements – Tests for Individual Items

#### Product Approval

- 4.1 The approval for use of individual items of the system will be through the mechanism of a Product Technical File (PTF) that must be submitted for each item by the Contractor to the Principal's Representative during the design process.

- 4.2 The Contractor must provide a comprehensive PTF for each item that is to be used in the construction and operation of the System.
- 4.3 The PTF for each item of equipment must have been submitted, reviewed and approved by the Principal's Representative prior to that equipment being installed.
- 4.4 Each PTF must follow a standard format that has been previously agreed with the Principal's Representative.
- 4.5 Each PTF must demonstrate the item complies with the requirements of this Contract and the system safety requirements. The PTF must cover the design, manufacture, operation and maintenance of the item to the extent necessary for the assessment to be made.
- 4.6 The PTF must include:
  - a) a general description of the item and its purpose in the system;
  - b) general arrangement and / or control circuit drawings along with the pertinent descriptions and explanations necessary for understanding the operation of the item;
  - c) detail drawings and descriptions, including any calculations, test results and certificates, required to demonstrate that the essential RAMS requirements have been complied with;
  - d) a risk assessment that identifies the essential safety requirements that apply to the equipment and a description of the protective measures incorporated to eliminate the identified risks;
  - e) the standards and other technical specifications used including the essential safety requirements covered by these standards;
  - f) the testing regime to demonstrate compliance with this Contract (e.g. frequency of Factory Acceptance Test (FAT)), including "Commercial Off the Shelf (COTS)" Components;
  - g) the operations and maintenance requirements for the item;
  - h) identification where the product has been used in a similar function elsewhere as it relates to environmental conditions;
  - i) spatial constraints (structure gauge, corridor width, on-board equipment locations);
  - j) non-functional safety requirements (manual handling, pinch points, ergonomics, etc.);
  - k) electromagnetic compatibility;
  - l) software safety (subject to application specific safety requirements);
  - m) hardware functional safety (subject to application specific safety requirements);
  - n) generic functionality and operation; and
  - o) overall reliability, availability and maintainability.
- 4.7 Provision of the PTF shall constitute a **Hold Point**.

## Factory Acceptance Tests

- 4.8 Factory Acceptance Tests (FAT) must be carried out before shipment to site of any item system to verify that it and its components are fit for its or their intended use and otherwise complies with the Contract Scope and Technical Requirements (CSTR) and the Contractor's design.
- 4.9 The Contractor must complete the FAT in accordance with the Contractor's method statements, ITP and test procedures.
- 4.10 When an item is not a Commercial Off the Shelf (COTS) product, and there is no suitable or existing standard or certificate to demonstrate fitness for its intended use in the AMPRN and compliance with the CSTR, the Contractor must carry out a Qualification Test to demonstrate that the item is fit for purpose, of the appropriate standard and quality and otherwise complies with the Contract.
- 4.11 When an item is already certified by another reputable organisation, a Qualification Test is not compulsory if suitable certificates that verify compliance of the component with the Contract are provided and the Principal's Representative accepts the certificates.
- 4.12 The Contractor must have approved FAT plan prior to test being completed.

- 4.13 Upon completion of testing the Contractor must issue the completed test records duly signed off with a Factory Acceptance Certificate (FAC) for the approval of the Principal's Representative.
- 4.14 Provision of the Factory Acceptance Certificate (FAC) and Test Records shall constitute a **Hold Point**.
- 4.15 For all items to be installed on site (including collections of identical ones), the Contractor must carry out Site Acceptance Tests in a manner acceptable to the Principal's Representative.

## 5 Inspection, Testing And Commissioning Requirements – Signal and Control System Engineering

- 5.1 In addition to sections 3, 4 and 11, the specific requirements for the inspection, testing and commissioning of the systems associated with signal and control system engineering must be in accordance with SG1-DOC-000452 Testing and Commissioning of Signalling Systems (Draft) and the CSTR.
- 5.2 These requirements shall constitute a **Hold Point**.

## 6 Inspection, Testing And Commissioning Requirements – Track and Civil Engineering

- 6.1 In addition to section 3, 4 and 11, the specific requirements for inspection, testing and commissioning of the systems associated with track and civil engineering must be in accordance with the CSTR and the Contractor's design.
- 6.2 These requirements shall constitute a **Hold Point**.

## 7 Inspection, Testing and Commissioning Requirements – Overhead Engineering

- 7.1 In addition to section 3, 4 and 11, the specific requirements for inspection, testing and commissioning of the systems associated with overhead engineering must be in accordance with the CSTR and the Contractor's design.
- 7.2 These requirements shall constitute a **Hold Point**.

## 8 Inspection, Testing and Commissioning Requirements – Electrical Engineering

- 8.1 In addition to section 3, 4 and 11, the specific requirements for inspection, testing and commissioning of the systems associated with electrical engineering must be in accordance with the CSTR and the Contractor's design.
- 8.2 These requirements shall constitute a **Hold Point**.

## 9 Inspection, Testing and Commissioning Requirements – Rolling Stock Engineering

- 9.1 In addition to section 3, 4 and 11, the specific requirements for inspection, testing and commissioning of the systems associated with Rolling Stock Engineering must be in accordance with the CSTR and the Contractor's design.
- 9.2 These requirements shall constitute a **Hold Point**.

## 10 Inspection, Testing and Commissioning Requirements – Communications and Electronic Systems Engineering

- 10.1 In addition to section 3, 4 and 11, the specific requirements for inspection, testing and commissioning of the systems associated with Communications and Electronic Systems Engineering must be in accordance with the CSTR and the Contractor's design.
- 10.2 These requirements shall constitute a **Hold Point**.

## 11 Inspection, Testing and Commissioning Requirements – Whole of System

### Static Tests / Site Acceptance Tests

- 11.1 The Contractor must complete the Static Test / Site Acceptance Tests (SAT) following the installation of an individual item.
- 11.2 The SAT must not commence until the Product Approval, FAT, Installation and Operational Testing have been completed and approval is received from the Principal's Representative.
- 11.3 The Contractor must develop, implement, maintain and comply with the SAT Plan.
- 11.4 The SAT must require witnessing by the Principal's representative.
- 11.5 The "AMPRN Rules and Procedures" provided by the Principal's Representative regulate matters such as safety measures, site constraints and communication measures with respect to train operations. The Contractor must co-operate fully with the Principal's Representative to ensure compliance.
- 11.6 In addition to testing individual systems, the interfaces between the Contractor's systems and those of others, including other contractors must be tested by simulation in accordance with CSTR and Contractor's design.
- 11.7 The Contractor must obtain requirements for the level of simulation required from the Principal's Representative.
- 11.8 The Contractor must supply the necessary level of simulation of its own systems to others on a timely basis.
- 11.9 Provision of the SAT shall constitute a **Hold Point**.
- 11.10 The static tests are undertaken in the following three sub-phases.

### Intermediate Static Tests

- 11.11 During the intermediate static tests, neither the systems nor their components are energised. The objective of the tests is to verify that the plant and material, systems and the works have been constructed and installed in accordance with this Contract and that the next sub-phase of testing can start without damaging any part of the System.
- 11.12 The intermediate static tests must verify that the plant and material, systems and the Works have been constructed and installed properly so that they do not adversely affect or impede the proper functioning of other systems.
- 11.13 The Contractor must issue an Installation Release Note to the Principal's Representative on successful completion of the intermediate static tests.

### Pre-commissioning Static Tests

- 11.14 The Contractor must undertake pre-commissioning static tests when the elementary components or sub-systems are energised. The objectives of these tests are similar to those described above in "intermediate static tests," but also serve to verify that the Plant and Material, systems and the works function in accordance with this Contract.



11.15 The Contractor must issue a pre-commissioning static test plan for each test or set of tests for the approval of the Principal's Representative. The test records must be submitted to the Principal's Representative for approval along with a Pre-Commissioning Certificate (PCC).

11.16 Provision of the test records shall constitute a **Hold Point**.

### System Static Tests

11.17 The Contractor must complete system static tests when all sub-systems that comprise an elementary System are connected in order to verify that the sub-systems work on an integrated basis.

11.18 In carrying out the system static tests, the Contractor must take into account the interface of the relevant systems with the systems of others including other contractors, the external railway operators and external facility networks.

11.19 The Contractor must issue a system static test plan for each of these tests, which must be approved by the Principal's Representative prior to execution. The plan must be completed with data from the testing activities and submitted with an Elementary System Acceptance Certificate for the approval of the Principal's Representative.

11.20 Please note that simulation tests may not be practical in some cases and this is defined in CSTR.

### System Integration Tests (SIT)

11.21 System integration tests are undertaken when the interfaces between all systems, including the interfaces with the systems of others including other contractors, the external railway operators and external facility networks are fully connected. The objectives and description of the tests are the same as those specified above in "System Static Tests."

11.22 The Contractor must obtain details of all necessary interface activities from the Principal's Representative, Others including other contractors.

11.23 The Contractor must test and operate the Contractor's equipment as required to support the testing of interfaces and integration with other systems where such interface and integration testing is carried out by the Principal's Representative or other contractors.

11.24 The Contractor must take into proper account, the operational constraints and include such constraints in the ITPs.

11.25 Provision of the test records and Pre-Commissioning Certificate (PCC) shall constitute a **Hold Point**.

### Dynamic Integration Tests

11.26 Throughout dynamic integration tests, the Principal's Representative will run passenger type train sets which will be used as test trains.

11.27 The Contractor must provide all the equipment that is necessary to carry out the required tests in regard to its systems under dynamic integration tests.

11.28 The Contractor must clearly document how the dynamic integration tests ensure System Integration with the remainder of the AMPRN as well as External Rail Transport Operator Networks, and Utility Services, if applicable.

11.29 The dynamic integration tests must verify that the design and installation of the plant and material, systems and the works comply with this Contract and that all system interfaces function and are integrated so that the system operates properly and safely.

11.30 Train operations will be progressively increased throughout this test to the level anticipated by the Principal's Representative for Trial or Test Running.

11.31 The Contractor must provide all assistance, co-operation, all documentation related to test carried during inspection, testing and commissioning required by the Principal's Representative to enable the Contractor to operate the Overall System until the commissioning hand over. The Contractor will test and commission its systems taking account the Principal's operation requirements during dynamic integration tests.

- 11.32 In the ITP, the Contractor must define the additional safety measures, such as those regarding track occupations and test tracks.
- 11.33 Throughout dynamic integration tests, whilst the Principal's Representative operates and is responsible for the Overall System (and specifically in accordance with the "AMPRN Rules and Procedures" with respect to railway operations), the Contractor must train the Principal's staff to operate its systems to enable the Principal's staff to operate the Overall System for trial runs in accordance with the Principal's requirements.
- 11.34 Operation Manuals (including the training documents) will be used during dynamic integration tests as though the AMPRN were in full commercial operation.
- 11.35 Provision of the test records and Provisional Asset Handover Certificate shall constitute a **Hold Point**.

## Trial or Test Running

- 11.36 The Principal's Representative operates the Overall System and conducts the necessary tests in accordance with the "AMPRN Rules and Procedures."
- 11.37 The Principal's Representative conducts the tests with the assistance of the Contractor who must provide the appropriate or necessary assistance, information, services, facilities and labour required to support the Principal's Representative during trial runs.
- 11.38 Trial runs must include a sufficient number of runs to "burn-in" the Overall System and allow for correction of any emergent faults and provide maintenance, Driver and Operator / Controller Training.
- 11.39 Trial runs must be carried out both during and outside of revenue service and will be coordinated by the Principal's Representative with the operating divisions of the railway. The Contractor must make staff available to support the activities.
- 11.40 A certificate of train / tram running from Infrastructure and Overhead Wiring and Certificate of Signalling shall be required before any test train or revenue train operates on the AMPRN.

## 12 Decommissioning and Disposal

- 12.1 The Contractor must take into account any decommissioning and disposal of an item or system in its Inspection, Testing and Commissioning Plan.
- 12.2 The Contractor must identify and list the item or system which needs to be decommissioned and disposed.
- 12.3 The Contractor must develop, implement, maintain and comply with the plan for safe shut down or dismantling of the system.
- 12.4 The Contractor must dispose of all redundant material, items and systems during the commissioning to avoid any infringement, confusion or distraction to train drivers, operators or maintainers.

## 13 Commissioning Handover

- 13.1 Commissioning hand over takes place when the Principal's Representative has recommended to the Principal and the Principal has accepted that all the relevant tests of the inspection, testing and commissioning including trial or test run has been successfully completed.
- 13.2 Submission of Commissioning results and Asset Handover Certificate shall constitute a **Hold Point**.
- 13.3 At the time of commissioning hand over, all documentation related to tests carried during inspection, testing and commissioning must have been provided progressively by the Contractor to the Principal's Representative and must have been accepted by the Principal.

## 14 Hold Points

- 14.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
3.4	Preliminary Inspection, Testing and Commissioning Management Plan	10 Working days prior Gate 4B
3.4	Final Inspection, Testing and Commissioning Management Plan	20 working days prior Gate 4C
3.7	Provision of each ITP	10 Working days prior Gate 4B
4.7	Product Technical File (PTF)	10 Working days prior Gate 4A
4.14	Factory Acceptance Certificate and Test Records	10 Working days before shipment or in accordance with CSTR
5 to 10	Inspection, Testing and Commissioning Requirements	20 working days prior Gate 4C
11.9	Site Acceptance Test (SAT) Plan	10 Working days prior to SAT, Gate 4C
11.16	Pre-commissioning Static Test Records	10 Working days prior to SIT, Gate 4C
11.25	System Integration Test (SIT) Records and PCC	10 Working days prior to Gate 4D
11.35	Dynamic Integration Test Records and Provisional Asset Handover Certificate	10 Working days prior to Gate 4D
13.2	Commissioning results and Asset Handover Certificate	10 Working days prior to Gate 4E

## 15 Records

- 15.1 The Contractor must develop, maintain and supply all records as necessary to provide evidence of compliance with the requirements of the Part in accordance with the requirements of PC-RW60 "Asset Management Handover".