PART CH91

TESTING AND COMMISSIONING (RAILWAYS)

CONTENTS

1. GENERAL

.1 This part specifies the requirements for the management of the testing and commissioning process. Refer also to Part G20 "Quality System Requirements".

.2 The following documents are referenced in this Part:

AS 4292:	Railway Safety Management
AS 9001:	Quality Management Systems – Requirements
PTS:	AR-PW-PM-PLN-00180001 Rail Revitalisation Test, Commissioning & Handover Strategy ("PTS 180001")
PTS:	PTSOM Integrated Safety Management System FR-SR-GE-002
PTS:	AR-PW-PM-PPD-00110011 Punch List Management Procedure ("PTS 110011")
PTS:	PTS-AR-10-EG-PRC-00203000 Procedure for Obtaining Type Approval ("PTS 23000")

.3 The following definitions apply:

For the purpose of this Part only, **"Component"** includes materials, plant and equipment.

"Punch List" means a list containing details of outstanding items, defects, faults, breakages etc. applicable to Commissioning Lots, sub-systems, or systems and identifying those responsible for remedying the items, the planned date for their remediation and the classification of the items.

"FAT" means Factory Acceptance Testing

"SAT" means Site Acceptance Testing

"SIT" means System Integration Testing

"Type Approval" means the documentation required to obtain approval for the installation of any new equipment (hardware and software) or design principles not commonly used on the AMPRN. The documentation may include technical specifications, Type Test plans for trial tests, typical circuits, approved methodologies in other railway networks.

"Type Test" means the testing applied to a single Component which enables other identical Components to be used without further Testing.

.4 The Contractor must 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 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.

2. CONTRACTOR'S RESPONSIBILITIES

.1 The Contractor is responsible for the testing and commissioning of its systems in accordance with the requiremenst of this Part.

.2 The Contractor must:

(a) establish, manage and co-ordinate the testing and commissioning principles, program, requirements and procedures.

(b) co-operate fully with the Principal who will take a support role throughout the testing and commissioning process.

(c) manage the interfaces of its systems with other systems, the external railway networks and the external facility networks.

(d) provide all necessary and appropriate assistance and co-operation to the Principal during phase 5 of the testing and commissioning process.

(e) implement the testing and commissioning requirements included in this Contract in accordance with principles defined in this Part;

(f) take into account the rules, procedures, constraints and practices of External Rail Transport Operators in formulating and implementing the testing and commissioning process and

(g) carry out Phases 0 to 4 (inclusive) of testing and commissioning in accordance with the ITCPs and V&V Plan.

3. TESTING AND COMMISSIONING MANAGEMENT PLAN

.1 The Contractor must establish, implement and maintain a Testing and Commissioning Management Plan which is suitable for demonstrating that the Works comply with the requirements of this Contract and the following parts of
AS 4292:

(a) Part 1: General Requirements;

(b) Part 2: Track, Civil and Electrical Infrastructure, excluding track and civil work; and

(c) Part 4: Signalling and Telecommunications Systems and Equipment,

.2 The Testing and Commissioning Management Plan must:

(a) address those parts of PTS 180001 which are relevant to the Contractor;

(b) describe the subcontractors and personnel undertaking testing and commissioning, including organisational structure, roles and responsibilities;

(c) describe the training, qualifications and/or certification of competency required for personnel undertaking testing and commissioning;

(d) include a list of all Components and Systems that will be subject to testing and commissioning;

(e) include or cross reference a detailed description of all testing and commissioning processes / procedures for all testing and commissioning listed in Clause 4 "Testing and Commissioning Stages";

(f) cross reference and / or integrate all Inspection and Test Plans developed pursuant to Clause 3. "Inspection and Test Plans"; and

(g) cross reference 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)

(h) outline the process that provides confirmation that all Requirements are met.

(i) include tests that prove that rollingstock, signalling, OHW and traction power systems all function correctly together.

(j) include tests that prove that the power quality and loads as measured by SA Power Networks are within modelled parameters.

(k) include tests that the traction system's effect on Utility Services and other railway services and infrastructure, are not causing operational issues and are within modelled parameters.

(l) include tests that demonstrate that short circuits do not cause unsafe step or touch potentials and do not disrupt other parts of the network, Utilities and other railways.

.3 Submission of the Testing and Commissioning Management Plan constitutes a **HOLD POINT**. The Testing and Commissioning Management Plan is a Controlled Document (refer Part G20 “Quality System Requirements”).

.4 The Contract Program must to identify the duration, critical path and interdependencies in relation to all testing and commissioning.

4. INSPECTION AND TEST PLANS

.1 The Contractor must develop, implement, maintain and comply with Inspection and Test Plans (ITP’s) so as to provide objective evidence of compliance with the requirements of this Contract. ITP’s must be developed as standard proformas, which at a minimum have provision for recording:

(a) description of activity and / or identification of applicable stages of construction / manufacture/ commissioning;

(b) clear cross referencing to:

i) the applicable clauses of the specification, and / or

ii) applicable test procedures / methods or Australian Standards used for the testing / commissioning;

(c) details of the method of verification for all specified requirements of the Contract, including those where verification is by control of process rather than inspection and testing at process completion;

(d) test frequency, acceptance criteria and records produced demonstrating compliance;

(e) details of the test equipment and where calibrated equipment is required, the calibration regime;

(f) the responsibility for testing / commissioning and acceptance;

(g) time, date and location of the inspection / testing / commissioning activity;

(h) a location on the ITP to record for comments;

(i) applicable Hold Points;

(j) details of any environmental conditions or external factors that may affect the results; and

(k) identification of the involvement of any subcontractors in the process.

(l) identification and management of safety risks which arise from the conduct of the testing and commissioning activities

.2 Provision of each ITP shall constitute a **HOLD POINT**. Each ITP proforma is a Controlled Document (refer Part G20 “Quality System Requirements”).

.3 The Contractor must maintain a register of ITP’s and include it in the Quality Plan or Testing and Commissioning Management Plan.

5. TESTING AND COMMISSIONING STAGES

.1 Each Component, subsystem, system and group of interrelated systems must be inspected, tested and commissioned by the Contractor at the stages specified in Table 5.1. Each test activity constitutes a **HOLD POINT**.

TABLE 5.1

TEST PHASE	DESCRIPTION	REQUIREMENTS
0	Product Approval	Refer Clause 6
1	Factory Acceptance Testing	Refer Clause 7 and PTS 180001
2	Static Tests per Elementary System including:	Refer Clause 8 and PTS 180001
3	Static Integration Tests	Refer Clause 9 and PTS 180001

TABLE 5.1		
TEST PHASE	**DESCRIPTION**	**REQUIREMENTS**
4	Dynamic Integration Tests	Refer Clause 10 and PTS 180001
5	Trail Runs	Refer Clause 12 and PTS 180001

.2 In undertaking testing and commissioning activities, the Contractor must:

(a) successfully complete each stage of testing and commissioning prior to commencing the next stage of testing and commissioning for each subsystem and system;

(b) submit details of the testing and commissioning activities for each system and stage a minimum of 60 days prior to the commencement of that stage of testing and commissioning, except where activities requiring track occupancy or power outages will interrupt existing railway operating facilities, where a longer minimum time will apply; as defined by the Principal;

(c) submit the Conformance Records for review within 10 days of completion of each stage;

(d) complete required training, unless otherwise agreed by the Principal's Authorised Person, prior to the commencement of the Acceptance Tests;

(e) submit a written report to the Principa at the end of each stage of testing and commissioning detailing the activities completed with the testing and commissioning results, and confirming that the tests and results were as required; and

(f) allow for and ensure the attendance of other parties to witness tests to verify and validate the compliance of the Works with the requirements of this Contract; and

(g) generate and maintain Punch Lists in accordance with PTS 110011.

6. PRODUCT APPROVAL (PHASE 0)

.1 The approval for use of individual items of equipment, cable and other such items will be through the mechanism of a Product Technical File (PTF) that must be submitted for each item by the Contractor to the Principal during the design process.

.2 The Contractor must provide a comprehensive PTF for each item that is to be used in the construction and operation of the System.

.3 The PTF for each item of equipment shall have been submitted, reviewed and approved by the Principal's Authorised Person prior to that equipment being installed on site.

.4 Each PTF must follow a standard format that has been previously agreed with the Principal's Authorised Person.

.5 Each PTF must demonstrate the equipment complies with the requirements of this Contract and the system safety requirements. The PTF must cover the design, manufacture and operation of the equipment to the extent necessary for the assessment to be made.

.6 The PTF must include:

(a) a general description of the equipment and its purpose in the system;

(b) general arrangement and control circuit drawings along with the pertinent descriptions and explanations necessary for understanding the operation of the equipment;

(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 (eg frequency of FAT), including "Commercial Off the Shelf" Components;

(g) the operations and maintenance requirements for the equipment; and

(h) identification where the product has been used in a similar function elsewhere as it relates to:

i) environmental conditions;

ii) spatial constraints (structure gauge, corridor width, on-board equipment locations);

iii) non-functional safety requirements (manual handling, pinch points, ergonomics, etc);

iv) electromagnetic compatibility;

v) software safety (subject to application specific safety requirements);

vi) hardware functional safety (subject to application specific safety requirements);

vii) generic functionality and operation (in comparison with Agreed Signalling or Electrification Principles); and

viii) overall reliability, availability and maintainability.

.7 Provision of the PTF shall constitute a **HOLD POINT**.

7. FACTORY ACCEPTANCE TESTS (PHASE 1)

.1 Factory Acceptance Tests (FAT) must be carried out before shipment to site of any item of plant and material to verify that it and its components are fit for its or their intended use and otherwise complies with the CSTR and the Contractor's design.

.2 The Contractor must complete the FAT in accordance with the Contractor's method statements, Quality Plan, ITCP and test procedures.

.3 When a component is not a 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 component is fit for purpose, of the appropriate standard and quality and otherwise complies with the Contract.

.4 When a component 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 Authorised Person accepts the certificates.

.5 The Contractor must prepare and submit to the Principal's Authorised Person a test plan for each FAT. The FAT plan must be accepted by the Principal's Authorised Person prior to the test being completed.

.6 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 Authorised Person.

.7 Provision of the test records shall constitute a **HOLD POINT**.

.8 For all components to be installed on site (including collections of identical ones), the Contractor must carry out Routine Tests in a manner acceptable to the Principal's Authorised Person.

8. STATIC TESTS PER ELEMENTARY SYSTEM (PHASE 2)

.1 The Contractor must carry out static tests on Plant and Material, systems and the Works.

.2 From the beginning of phase 2 of testing and commissioning up to the commissioning hand over, the "Operating Rulebook", provided by the Principal, will 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 to ensure compliance.

.3 In addition to testing individual systems, the interfaces between the Contractor's systems and those of others, including other contractors, the external railway networks and external facility networks must be tested by simulation.

.4 The Contractor must obtain requirements for the level of simulation required from the Principal's Authorised Person, other contractors, the external railway networks and external facility networks, which are necessary for the Contractor to properly carry out its interface tests, and the Contractor must provide its requirements to Others where necessary or appropriate.

.5 The Contractor must supply the necessary level of simulation of its own systems to others on a timely basis.

.6 The static tests are undertaken in the following three sub-phases.

Intermediate Static Tests (Phase 2.1)

.7 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, the AMPRN, the external railway networks or the external facility networks.

.8 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.

.9 The Contractor must issue an Installation Release Note to the Principal's Authorised Person on successful completion of the intermediate static tests.

Pre-commissioning Static Tests (Phase 2.2)

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

.12 Provision of the test records shall constitute a **HOLD POINT**.

.13 The Contractor may set to work the items for which pre-commissioning static test have been successfully completed.

System Static Tests (Phase 2.3)

.14 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.

.15 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 networks and external facility networks. This testing may include the simulation of such interfaces if the connections have yet to be completed or would involve operational disruption.

.16 The Contractor must issue a system static test plan for each of these tests, which must be approved by the Principal's Authorised Person 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 Authorised Person.

9. STATIC INTEGRATION TESTS (PHASE 3)

.1 Static integration tests are undertaken when the interfaces between all systems, including the interfaces with the systems of others including other contractors, the external railway networks 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".

.2 The Contractor must obtain in timely manner details of all necessary interface activities from the Principal's Authorised Person, Others including other contractors, the external railway networks and the external facility networks. The Contractor must carry out the tests with the necessary interface activities required from others including other contractors, the Principal the external railway networks and external facility networks.

.3 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 or other contractors.

.4 The Contractor must take into proper account, the operational constraints required by the Principal, from other contractors, external railway networks and external facility networks. The Contractor must include such operational constraints in the ITCPs.

.5 The Contractor must forecast the operational requirements for phase 4 dynamic integration tests, to the Principal, on a timely basis prior to the end of phase 3 static integration tests, to enable the integration of its requirements into the testing and commissioning process for phase 4.

.6 Provision of the test records shall constitute a **HOLD POINT**.

10. DYNAMIC INTEGRATION TESTS (PHASE 4)

.1 Throughout phase 4, Dynamic Integration Tests, the Principal will rune passenger type train sets which will be used as test trains.

.2 The Contractor must provide all the equipment that is necessary to carry out the required tests in regard to its systems under phase 4.

.3 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.

.4 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.

.5 Train operations will be progressively increased throughout phase 4 to the level anticipated by the Principal for phase 5, Trial Runs.

.6 The Contractor must provide all assistance, co-operation, documentation and information reasonably required by the Principal's Authorised Person and the Principal 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 phase 4, Dynamic Integration Tests.

.7 In the ITCP, the Contractor must define the additional safety measures, such as those regarding track occupations and test tracks, required for any tests involving the external railway networks and those involved in the external facility networks.

.8 Throughout phase 4, whilst the Principal operates and is responsible for the Overall System (and specifically in accordance with the Operating Rulebook 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 phase 5, trial runs in accordance with the Principal's requirements.

.9 Operation Manuals (including the training documents) will be used during phase 4, Dynamic Integration Tests as though the AMPRN were in full commercial operation.

11. COMMISSIONING HAND OVER

.1 Commissioning hand over takes place when the Principal's Authorised Person has recommended to the Principal and the Principal has accepted that phase 4, dynamic integration tests of the testing and commissioning has been completed.

.2 Submission of Commissioning results and Certification shall constitute a **HOLD POINT**.

.3 At the time of commissioning hand over, all documentation related to tests carried out from phase 0 through to the end of phase 4 of testing and commissioning must have been provided progressively by the Contractor to the Principal and must have been accepted by the Principal.

12. TRIAL RUNNING (PHASE 5)

.1 The Principal operates the Overall System and conducts the necessary tests in accordance with the Operating Rulebook.

.2 The Principal 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 during phase 5, trial runs.

.3 Phase 5: 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. This phase must be carried out both during and outside of revenue service and will be coordinated by the Principal's Authorised Person with the operating divisions of the railway. The Contractor must make staff available to support the activities.

.4 During trial operations and for a period of 30 days post commissioning the system must be put under surveillance to ensure the system meets operational, functional and performance requirements described by this Contract.

13. TYPE APPROVAL

.1 Where the Contract requires the application of a Type Approval process, the process must follow PTS 23000.

.2 Where a DPTI procedure does not exist, the Contractor must provide a proposed procedure for Type Approval to the Principal's Authorised Person.

.3 Provision of this procedure shall be a **HOLD POINT**.

14. HOLD POINTS

.1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
3.3	Testing and Commissioning Management Plan	10 working days
4.2	Provision of each ITP	10 working days
6.7	Product Technical File	10 Working Days
7.7	Factory Acceptance Certificates	10 Working Days
8.12	pre-commissioning static test	10 Working Days
9.6	Static integration tests	10 Working Days
11.2	Commissioning results and Certification	10 Working Days
13.3	Type Approval	10 Working days