Specification
For
Commissioning and Handover Requirements For
Treatment Plants
Pr8874
**Pr8874 - Commissioning and Handover Specification Treatment Plants**

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<thead>
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**References**

<table>
<thead>
<tr>
<th>Reference</th>
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<tbody>
<tr>
<td>Pr8843</td>
<td>Major Projects Specification for Drawing, Document and Equipment TAG Numbering</td>
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<tr>
<td>Pr9835</td>
<td>Specification for Electrical Installations at Treatment Plants</td>
</tr>
<tr>
<td>Pr9902</td>
<td>Specification for Civil and Earth Works</td>
</tr>
<tr>
<td>Pr9875</td>
<td>Specification for Non Pressure Pipe Construction</td>
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<td>Pr9904</td>
<td>Specification for Pressure Pipe Construction</td>
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<td>Pr9903</td>
<td>Specification for Structural and Building Works</td>
</tr>
<tr>
<td>Pr9693</td>
<td>Specification for Mechanical Installations</td>
</tr>
<tr>
<td>Pr9076</td>
<td>Guide for Planning Major Projects Handover Deliverables</td>
</tr>
<tr>
<td>Pr9078</td>
<td>Specification for As Constructed Information</td>
</tr>
<tr>
<td>Pr9080</td>
<td>CAD Drafting Standard Asset Creation</td>
</tr>
</tbody>
</table>
# Contents

**1. Introduction** ................................................................................................................... 6  
  1.1 Overview ................................................................................................................ 6  
  1.2 Commissioning Objectives ..................................................................................... 6  

**2. Management Approach** ................................................................................................. 7  
  2.1 Commissioning Organisation ................................................................................. 7  
  2.2 Commissioning and Performance Test Stages ....................................................... 8  
  2.3 Roles of key Commissioning Staff .......................................................................... 9  
    2.3.1 UWP Project Manager ........................................................................... 9  
    2.3.2 UWP Lead Commissioning Engineer ................................................... 10  
    2.3.3 UWTP Representative ......................................................................... 10  
    2.3.4 Principal Contractor Project Manager ................................................... 10  
    2.3.5 Principal Contractor Commissioning Engineer ..................................... 11  
    2.3.6 Designer’s Commissioning Representative .......................................... 11  
  2.4 Contractor’s Commissioning Plan ........................................................................ 12  
  2.5 Safety and Environment ....................................................................................... 13  
    2.5.1 Safety Management Plan ..................................................................... 13  
    2.5.2 Isolation Permits .................................................................................. 14  
    2.5.3 Environmental Management ................................................................ 14  
    2.5.4 Risk Workshop ..................................................................................... 14  
  2.6 Meetings & Reporting........................................................................................... 15  
    2.6.1 Weekly Commissioning Meetings ......................................................... 15  
    2.6.2 Daily Pre-Starts .................................................................................... 15  
    2.6.3 Weekly Report ..................................................................................... 15  

**3. Process Management** ................................................................................................. 16  
  3.1 Pre-Commissioning .................................................................................................. 16  
    3.1.1 Overview .................................................................................................. 16  
    3.1.2 Pre-Commissioning Documentation ......................................................... 17  
    3.1.3 Factory Acceptance Testing (FAT) and Inspection ..................................... 17  
    3.1.4 On-Site Installation and Pre-Commissioning Tests ................................... 17  
    Hydrostatic Testing of Structures and Pipes ..................................................... 18  
    Mechanical Equipment Tests ......................................................................... 18  
    Electrical Equipment Tests ............................................................................ 18  
    General Equipment Tests ............................................................................... 19  
    Control Equipment Tests ................................................................................. 19  

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Pr8874 - Commissioning and Handover Specification Treatment Plants

Calibration of Instruments and Equipment ....................................................... 19

3.2 Wet Commissioning .................................................................................. 19
   3.2.1 Equipment Performance Testing .......................................................... 21

3.3 Completion of Wet Commissioning .............................................................. 21
   3.3.1 Defects and Omissions Punchlist .......................................................... 22

3.4 Process Commissioning ............................................................................. 22

3.5 Process Performance Test .......................................................................... 23

3.6 Practical Completion .................................................................................. 23
   3.6.1 Work on Equipment after Practical Completion .................................... 24

3.7 Handover to Unitywater ............................................................................. 24

3.8 Target Dates for Commissioning Related Activities .................................... 24

4. Commissioning Information Management .................................................. 25
   4.1 Commissioning Documentation and Quality Control ............................... 25
       4.1.1 Commissioning Method Statements ................................................ 27
       4.1.2 Inspection and Test Checksheets ....................................................... 27
       4.1.3 Inspection and Test Plans ................................................................. 29
       4.1.4 Unitywater Signoff ........................................................................... 30

5. Handover Deliverables ................................................................................. 30
   5.1 Handover Documentation ........................................................................ 30
       5.1.1 General Introduction and Process Overview ..................................... 30
       5.1.2 Unit Process Guidelines .................................................................... 30
       5.1.3 Standard Operating Procedures ...................................................... 31
       5.1.4 Functional Description ...................................................................... 32
       5.1.5 Functional Specification .................................................................... 32
       5.1.6 PLC and SCADA Manual ................................................................. 32
       5.1.7 HAZOP/CHAZOP Reports ................................................................. 32
       5.1.8 Vendor Manuals (Proprietary Equipment O&M Manuals) .................. 32
       5.1.9 Vendor Recommended Maintenance Routines & Spares ................... 33
       5.1.10 Statutory Certifications .................................................................... 33
       5.1.11 Warranty Register ............................................................................ 34
       5.1.12 Process Performance Test Report ..................................................... 34
       5.1.13 Final Commissioning Report ............................................................. 34
       5.1.14 Training Records .............................................................................. 34
       5.1.15 ‘As Constructed’ Drawings ............................................................... 35
       5.1.16 Compilation of Final Handover Documentation ................................. 35
       5.1.17 Handover Documentation Index ....................................................... 35
5.2 Other Handover Deliverables

5.2.1 Operator Training

5.2.2 Asset Registration

5.2.3 PLC/SCADA Assistance

5.2.4 Electronic Records

PLC/SCADA Software

Training Videos

Annexe A. Abbreviations

Annexe B. Example CMS

Annexe C. Example Commissioning ITP

Annexe D. Example Commissioning Checksheet (ITC)

Annexe E. Typical Handover Documentation Structure

List of Tables

Table 1 – Target Dates for Commissioning Related Activities

Table 2 - Example Commissioning Workpacks

Table 3 - Example ITP Structure

Table 4 - Example ITP Structure

List of Figures

Figure 1 - Typical Commissioning Organisation

Figure 2 - Commissioning Stages, Site Responsibility and Major Milestones (Typical Model for DBB Contracts)

Figure 3 - Commissioning Stages, Site Responsibility and Major Milestones (Typical Model for D&C Contracts)

Figure 4 - Example Hierarchy of Commissioning Documentation
1. Introduction

1.1 Overview

1.1.1 The purpose of this Specification is to define Unitywater’s requirements for commissioning and handover of Treatment Plant Projects. Clear definition of roles and responsibilities will ensure that Treatment Plant Projects are commissioned and handed over to Unitywater in accordance with the Project requirements and to the satisfaction of all parties.

1.1.2 The following aspects are addressed within this Specification:

- Objectives, management structure and communication protocols;
- Key roles, responsibilities and ownership of all parties, namely:
  - The Principal Contractor;
  - Unitywater Major Projects, and;
  - Unitywater Treatment Plants;
- Sequence and methodology for commissioning and commissioning sub-stages;
- Commissioning activities and related administrative requirements and ensuring these are coordinated and integrated into the final handover package;
- Possession of the plant and equipment at various stages in order to control responsibility for safety, operation and maintenance;
- Performance criteria; and
- Handover deliverables.

1.2 Commissioning Objectives

1.2.1 The overall objective of the commissioning stage of the project is to ensure that the components of the Plant are complete, operational and meet Unitywater’s requirements.

1.2.2 Objectives will be achieved by carrying out the following tasks:

- Construction completion to confirm that all installation and systems have been finalised and checked;
- Pre-commissioning to confirm each piece of equipment is fit for purpose;
- Wet Commissioning each section of the plant on service or potable water to confirm correct functionality and performance where possible;
- Process commissioning by starting up the Plant on sewage in the appropriate sequence; and
- Manage the operation and process performance testing of the Plant to achieve commissioning completion.

1.2.3 Overall commissioning will be complete when all Plant performance and other conditions for handover to Unitywater, outlined below, have been met:

- Commissioning and Process Performance Testing of the Plant has been completed;
• The Plant has been demonstrated to be capable of meeting the output specification set out in the Project Brief;
• Completion of category A, B and C Punch List items;
• The completion of “As-Constructed” drawings; and
• All other handover deliverables (refer Section 5) have been provided.

2. Management Approach

2.1 Commissioning Organisation

2.1.1 The commissioning team will comprise personnel from various organisations, including:
• The Principal Contractor;
• The Designer;
• Unitywater Major Projects; and
• Unitywater Treatment Plants.

The Figure below shows the typical commissioning organisational structure.

**Figure 1 - Typical Commissioning Organisation**
2.2 Commissioning and Performance Test Stages

2.2.1 Commissioning and Performance Testing will be broken down into stages which will allow responsibilities to be defined.

2.2.2 The Commissioning and Performance Testing will incorporate the following stages:

- Pre-Commissioning of individual components (dry commissioning);
- Wet Commissioning and Equipment Performance Testing;
- Process Commissioning;
- Process Performance Test;
- Commissioning Completion and Handover.

2.2.3 The actual tasks to be carried out for each commissioning stage are detailed in Section 3 of this Specification.

2.2.4 The Figure below shows site responsibility throughout the commissioning and handover phases and illustrates major milestones.

Figure 2 - Commissioning Stages, Site Responsibility and Major Milestones (Typical Model for DBB Contracts)
2.3 Roles of key Commissioning Staff

2.3.1 UWP Project Manager

2.3.1.1 The Unitywater Major Project Manager will:

- Liaise with the Designer, Principal Contractor and Unitywater Treatment Plants personnel;
- Manage Unitywater project personnel;
- Ensure that commissioning is completed in a timely and cost-effective manner;
- Adhere the ‘Permit to Work’ and tagging / isolation procedures;
- Ensure a seamless transitions from the Principal Contractor to UWP Commissioning to Treatment Plant Operations;
- Ensure the commissioning requirements of this Specification are met;
- Ensure that all occupational health and safety and workplace regulations are met;
- Ensure that all environmental and quality assurance targets are met;
- Manage communication with Stakeholders;
2.3.2 UWP Lead Commissioning Engineer

2.3.2.1 The Unitywater Major Project Lead Commissioning Engineer will:

- Report directly to the UWP Project Manager;
- Manage Unitywater commissioning personnel Liaise with the Principal Contractor and Unitywater Treatment Plants personnel;
- Ensure the Contractor's Commissioning Plan, Method Statements and Inspection and Testing Plans are established and maintained, including maintaining traceability of all checks undertaken;
- Organise the delivery of the on-the-job training for Treatment Plant Operations and Maintenance Personnel;
- Adhere to 'Permit to Work' and tagging/isolation procedures;
- Ensure a seamless transition from the Principal Contractor to UWP Commissioning;
- Manage the testing process for water quality and proving tests;
- Ensure the commissioning requirements of this Specification are met;
- Ensure that all occupational health and safety and workplace regulations are met;
- Ensure that all environmental and quality assurance targets are met;
- Sign off all Principal Contractor commissioning documentation prior to Practical Completion;
- Ensure completion of “As Commissioned” handover deliverables.

2.3.3 UWTP Representative

2.3.3.1 Unitywater’s Treatment Plants Representative will:

- Ensure that commissioning checks have been adequately completed;
- Operate the plant during process commissioning and performance testing;
- Adhere to ‘Permit to Work’, tagging and isolation procedures;
- Ensure that all occupational health and safety and workplace regulations are met;
- Ensure that all environmental and quality assurance targets are met;
- Ensure Operator and Maintenance personnel are suitably trained;
- Assist in preparing Risk Assessments.

2.3.4 Principal Contractor Project Manager

2.3.4.1 The Principal Contractor Project Manager shall:

- Achieve all requirements for Practical Completion;
- Liaise with the Unitywater Major Projects and Treatment Plant Operations personnel;
- Manage the Contractor’s commissioning personnel;
2.3.5 Principal Contractor Commissioning Engineer

2.3.5.1 The Principal Contractor's Commissioning Engineer shall:

- Ensure that pre-commissioning and wet commissioning is completed in a timely and cost-effective manner and to the satisfaction of the Client;
- Adhere the ‘Permit to Work’ and tagging/isolation procedures;
- Ensure a seamless transition from the Principal Contractor to UWP Commissioning;
- Ensure the commissioning requirements of this Specification are met;
- Ensure all occupational health and safety and workplace regulations are met;
- Ensure all environmental and quality assurance targets are met.

2.3.6 Designer's Commissioning Representative

2.3.6.1 The Designer's Commissioning Representative will:

- Report directly to the Principal Contractor Project Manager;
- Responsible for commissioning tasks and deliverables specified in Table 1 - Target Dates for Commissioning Related Activities;
- Manage and direct contractor commissioning staff;
- Liaise with the Unitywater Lead Commissioning Engineer;
- Conduct the weekly Commissioning Meetings;
- Ensure that the Contractor's Commissioning Plan, Method Statements and Inspection and Testing Plans are established and maintained, including maintaining traceability of all checks undertaken;
- Ensure that non-compliance reports are closed off;
- Organise the delivery of training for Treatment Plant Operations and Maintenance Personnel;
- Attend the weekly Commissioning Meetings;
- Adhere the ‘Permit to Work’ and tagging/isolation procedures;
- Ensure a seamless transition from the Principal Contractor to UWP Commissioning;
- Ensure the commissioning requirements of this Specification are met;
- Ensure all occupational health and safety and workplace regulations are met;
- Ensure all environmental and quality assurance targets are met.
• Assist in delivering on-the-job training in process optimisation for the Treatment Plant Operations and Maintenance team;

• Assist the UWP Lead Commissioning Engineer or Principal Contractor’s Commissioning Engineer in achieving acceptable results during the Performance Test as required by the Contract;

• Validate the Plant’s operation against the design.

### 2.4 Contractor’s Commissioning Plan

2.4.1 The Principal Contractor is required to prepare a Commissioning Plan.

2.4.2 The Contractor’s Commissioning Plan must be submitted to Unitywater for approval a minimum of 6 weeks prior to commencing any commissioning activities. No commissioning activities may commence until the Plan has been approved.

2.4.3 The Plan is to address program, methodology and workpack management for all commissioning to be undertaken by the Contractor in accordance with this Specification.

2.4.4 The Plan shall also address performance criteria as set out in the Job Specification.

2.4.5 The Commissioning Plan must fully define the checks, inspections, performance tests and other tests that the Contractor proposes to carry out to ensure that the Works are complete and operational in accordance with the Project Specification.

2.4.6 The Contractor’s Commissioning Plan must include the following information as a minimum:

i. Overview, purpose and scope of the Commissioning Plan;

ii. Commissioning team organisational structure and resourcing, including:

   • Nominated Commissioning Manager;
   
   • Nominated commissioning lead engineers for each engineering discipline, including process, civil, mechanical, electrical and control;

   • A description of the role, responsibilities, allocated hours, qualifications and experience of each commissioning team member;

   • Overall organisational chart and communication protocols to apply during testing, commissioning and Proof of Performance Testing;

   • The roles and responsibilities of the Contractor’s team, Unitywater Major Projects personnel and Unitywater Treatment Plants personnel during testing, commissioning and Proof of Performance Testing;

iii. The methodology and tests which will be implemented during testing, commissioning and Proof of Performance Testing to prove that the Plant is consistent with the approved design and operates in accordance with requirements of the Contract. As a minimum, this must include:

iv. Commissioning risk management plan;

   • Definition of Plant Commissioning areas and battery limits;

   • Details of all factory acceptance testing;

   • Details of all site testing, including site acceptance testing;
• Details of the testing, pre-commissioning, wet commissioning and process commissioning methodologies; and

• Details of all Proof of Performance Testing, including the proposed operating conditions and operational parameters to ensure that each process unit is tested at the specified and critical loads;

v. Procedures for pre-commissioning, wet commissioning and process commissioning, covering each of the scope items included in the Contract; the details provided must include:
   • The full methodology, sequence, monitoring and acceptance criteria which will be applied to each Commissioning inspection and test;
   • The fault simulation, plant shutdown, restart, flow variations, set point variations and associated measures to be applied to each test;
   • All testing, pre-commissioning, wet commissioning, process commissioning and Proof of Performance Testing checklists and procedures, inclusive of all inspection and testing plans (ITPs) and/or inspection and testing check sheets (ITCs);

vi. Documentation for completion of each factory acceptance tests (FATs) including but not limited to material tests, manufacturing tests, mechanical equipment tests, electrical equipment tests, control and monitoring equipment tests. FAT check sheets must cover every aspect of operation for every item of equipment;

vii. A detailed commissioning risk assessment, including a commissioning risk workshop to identify key risks and risk mitigation measures and develop safety procedures; the Contractor’s proposed safety procedures must be detailed in the Commissioning Plan;

viii. A detailed commissioning program for the proposed testing, commissioning and Proof of Performance Testing; the program must take the form of a Gantt Chart and identify dates and duration of all activities for all tests and Hold Points;

ix. Details of commissioning information management including a register of all commissioning documentation to be used; and

x. Supporting documentation including but not limited to Commissioning Work Packs, Method Statements, ITPs, ITCs, FAT forms and SAT forms as a minimum.

2.4.7 The submission and approval of the Contractor’s Commissioning Plan will be a Hold Point. No testing may commence until the Commissioning Plan has been reviewed and approved by Unitywater.

2.5 Safety and Environment

2.5.1 Safety Management Plan

2.5.1.1 The Principal Contractor is required to prepare and maintain a Project Safety Management Plan for the duration of the Project.

2.5.1.2 OH&S Risks associated with all phases of commissioning activities shall be identified and appropriately control measures adopted. The preparation and implementation of approved safety procedures, in compliance with the Project Safety Management Plan shall be a prerequisite to commencement of any commissioning activity.
2.5.1.3 In the event of an emergency during the Commissioning Phase the Emergency procedures contained in the Safety Management Plan will be followed and adhered to.

2.5.1.4 Immediately following the issue Practical Completion the responsible person nominated in the Safety Management Plan will be replaced by Unitywater Personnel. The Plan will remain in force until handover of the Plant to Unitywater Treatment Plants.

2.5.2 Isolation Permits

2.5.2.1 It is essential that when work is to be carried out, on plant or equipment that has the potential to release hazardous energy, the plant or equipment is isolated and all hazardous energy sources are removed. Isolation as detailed in the Contractor’s Project Safety Management Plan is required on all energised plant or equipment (considered ‘live’) and it is deemed unsafe by the relevant supervisor to perform work on or near that plant or equipment without it being isolated.

2.5.2.2 The Contractor’s Project Safety Management Plan will define the process of isolation to ensure protection for personnel who may be required to work on equipment that has the potential to inadvertently energise. It uses application of isolation devices, locks and tags.

2.5.2.3 This procedure will define a series of predetermined steps that should be followed to prevent the release of hazardous energy, in order to protect the safety of workers during Plant building, testing, inspection, repair, maintenance or cleaning activities during the construction, commissioning and operation phases of the project.

2.5.2.4 The aim is to ensure:

- All forms of potentially hazardous energy are isolated to ensure that an accidental release of hazardous energy does not occur.
- All other hazards and potential dangers to those performing the work are controlled.

2.5.3 Environmental Management

2.5.3.1 The Principal Contractor is required to prepare and maintain a Project Environmental Management Plan for the duration of the Project.

2.5.3.2 Environmental risks and hazards associated with all stages of commissioning activities shall be identified and appropriate control measures adopted. The implementation of appropriate environmental hazard control measures, in compliance with the Projects Environmental Management Plan, shall be a prerequisite to commencement of any commissioning activity.

2.5.4 Risk Workshop

2.5.4.1 A risk workshop shall be carried out prior to commencement of commissioning to identify and mitigate risks to personnel, equipment, the overall treatment process and the environment.

2.5.4.2 The risk workshop shall be conducted by the Principal Contractor and at least one representative from the Principal Contractor, Designer, Unitywater Major Projects and Unitywater Treatment Plants shall participate.

2.5.4.3 Risks and OHS hazards associated with all stages of commissioning activities shall be identified and appropriate control measures adopted.
2.5.4.4 The preparation and implementation of approved safety procedures shall be a prerequisite to commencement of any commissioning activity.

2.6 Meetings & Reporting

2.6.1 Weekly Commissioning Meetings

2.6.1.1 Commissioning meetings, at which all stakeholders shall be represented, will be held before and throughout the Commissioning stage. Minutes of the commissioning weekly meetings will be recorded and distributed to all stakeholders after the meeting.

2.6.1.2 Issues to be discussed at the weekly commissioning meetings will include:

- Commissioning program and procedures;
- Commissioning resource requirements and allocation;
- Commissioning progress to date;
- Interface issues between Construction, Commissioning and Operations, such as Punchlists, handover of sub-systems, safety requirements, operational requirements;
- Planned major events, e.g. shutdowns, introducing water through structures, performance test periods.

2.6.2 Daily Pre-Starts

2.6.2.1 A daily pre-start or meeting will be held each working day, in compliance with the Project Safety Management Plan and led by the Principal Contractor Commissioning Engineer.

2.6.2.2 All personnel involved in commissioning work on the project site that day must attend the pre-start/meeting. This meeting will cover typical items such as safety and environment issues. It will also cover daily planning of commissioning activities, identification of work permits, resolution of interface issues etc.

2.6.2.3 The pre-start sign-on register will minute the items recorded in the pre-start.

2.6.3 Weekly Report

2.6.3.1 A brief weekly report will be prepared by the Principal Contractor Commissioning Engineer.

The preparation of a brief report is a good tool for maintaining focus on the activities ahead. It not only communicates the status to the wider project team but also helps the commissioning team to maintain documentation on a regular basis and focus on the targets to be met in the following month.

2.6.3.2 The report will include:

- Summary of Work completed in previous week;
- Targets for next week;
- Status of pre-commissioning (% complete by equipment type);
- Status of wet commissioning (% complete by system);
- Status of punchlist items;
3. **Process Management**

3.0.1 Commissioning will incorporate the following stages:

- Pre-Commissioning of individual components (dry commissioning);
- Wet Commissioning and Equipment Performance Testing;
- Process Commissioning;
- Process Performance Test;
- Compilation of Handover Deliverables and final Handover to Treatment Plant Operations.

3.0.2 The actual tasks to be carried out for each commissioning stage are detailed in the following sections.

3.0.3 The commissioning stage of the project interfaces directly with the construction and operating phases of the project. Thus the commissioning stage is a critical step in achieving seamless transition from Pre-commissioning to Process Performance Testing and subsequent handover to Unitywater.

3.0.4 This section of this Specification details the different commissioning phases.

3.1 **Pre-Commissioning**

3.1.1 **Overview**

3.1.1.1 Pre-Commissioning is the testing of each individual component for correct installation and operation. The pre-commissioning checks include factory works testing and on-site inspections and tests.

3.1.1.2 Pre-commissioning shall ensure that on completion of installation, the works are inspected in a systematic manner, are safely energised and able to be put into operation and that the results of these inspections and tests are suitably recorded. All items of plant and equipment and their ancillaries will be pre-commissioned, and any non-compliance rectified.

3.1.1.3 The pre-commissioning checks will incorporate tests and/or documentation from the following testing stages:

- Supplier Factory Works Testing and Inspections;
- On-site Installation and Pre-commissioning Tests.

3.1.1.4 In most cases pre-commissioning requirements will be satisfied by checks carried out on-site the Principal Contractor, their subcontractors, or by factory acceptance testing (FAT) by the manufacturer.
3.1.2 Pre-Commissioning Documentation

3.1.2.1 Inspection and Testing Plans (ITP) and / or Inspection and Testing Check Sheets (ITC) shall be used to record the outcome of testing and verification of testing completed during the Pre-commissioning sub-phases.

3.1.2.2 ITPs and/or ITCs shall be prepared for all equipment pre-commissioning checks. All ITPs/ITC’s shall be submitted to the Client’s Superintendent at least 28 days prior to commencing pre-commissioning for review and approval (as detailed in Section 3.8), including the required Client “Witness” and “Hold points”. Commissioning documentation and quality recording requirements are detailed in Section 4.1 of this Specification.

3.1.2.3 The minimum requirements for pre-commissioning tests are defined in the following sections. The required pre-commissioning checks must be completed and appropriate sections of the Inspection and Testing Plans filled in.

3.1.3 Factory Acceptance Testing (FAT) and Inspection

3.1.2.1 If suppliers/manufacturers have performed tests and inspections at their factory or on site, records of testing shall be reviewed as part of the pre-commissioning verification.

3.1.2.2 The scope of factory acceptance testing and inspection will be included in the supplier’s ITPs.

3.1.2.3 The FAT of major items may include but not be limited to:

- Material tests;
- Manufacturing tests;
- Mechanical equipment tests;
- Electrical equipment tests;
- Control and monitoring equipment tests.

3.1.4 On-Site Installation and Pre-Commissioning Tests

3.1.2.1 The on-site testing required during the Pre-commissioning phases is summarised below:

- Hydrostatic Testing of Structures and Pipes
- Mechanical equipment checks and testing
- Electrical equipment checks and testing
- General Equipment Tests
- Control equipment checks and testing
- Calibration tests for instruments and equipment

3.1.2.1 Tests shall be carried out to verify that the plant and equipment will operate under the full range of operating conditions and meet the performance requirements. Loads necessary to facilitate System Commissioning of the plant will be simulated.

3.1.2.2 Inspection and testing for pre-commissioning shall include, where applicable to the equipment item being tested, the following:
Hydrostatic Testing of Structures and Pipes

3.1.2.3 Hydrostatic testing of tanks, pipes and other structures will be carried out as a pre-commissioning/construction activity. Filling of structures must be carried out in a controlled and safe manner. Monitoring and recording regimes for the hydrostatic testing must be followed to the satisfaction of the Unitywater.

3.1.2.4 Hydrostatic testing of civil structures pipework shall be performed in accordance with Unitywater’s Standard Specifications.

Mechanical Equipment Tests

3.1.2.5 Mechanical equipment tests include at least the following:

- Verify factory assembled equipment have not been damaged by installation;
- All delivery blocks have been removed and equipment ready for operation;
- Check that equipment is correctly lubricated and lubrication reservoirs charged with suitable lubricant;
- Check clearance, end play and operation of major bearings;
- Check alignment of drive systems;
- Check tightness of all parts;
- Correct installation of guards, trip wires and other personnel safety equipment;
- Ensure the system has been cleaned and flushed;
- Test feedback, control and overload equipment, including safety checks;
- Check direction of rotation and performance of electric motors;
- Pre-commissioning runs of rotating equipment;
- Functional tests of equipment;
- Testing and adjustment of safety devices;
- Submission of power factor correction report and other requirements for entire plant;
- Check valve positions;
- Where possible, prime all pumps prior to wet commissioning;
- Check of lifting facilities.

Electrical Equipment Tests

3.1.2.6 Electrical equipment tests include at least the following:

- Point to point tests;
- Electrical integrity tests, including electrical tests for insulation, earth leakage, resistance to high voltage;
- Voltage tests;
- Trip tests;
• Functional tests;
• Check of range / settings of equipment.

**General Equipment Tests**

3.1.2.7 General equipment tests include at least the following:

- Check of completeness of installation;
- Inspections and where required approvals to ascertain compliance with statutory requirements and regulations;
- Check of access to valves and equipment;
- Simulation of fault conditions.

**Control Equipment Tests**

3.1.2.8 Inspection and testing of control equipment for pre-commissioning shall include, where applicable to the equipment item being tested, the following:

- Check of completeness of installation;
- Functional testing of control equipment;
- Calibration tests, where applicable, or calibration certificates;
- Check of loops, interlocks, inputs, etc.;
- Check of PLC and SCADA logic;
- Calibrate and test all instruments and analysers, as addressed below;
- Simulation of fault conditions.

**Calibration of Instruments and Equipment**

3.1.2.9 The pre-calibration checking of instruments will include confirmation that manufacturing checks have been performed.

3.1.2.10 Pre-commissioning instrument and equipment calibration tests will also include the following checks:

- Check of instrument setup and calibration by comparison with a reference instrument or by direct measurement;
- Checks that all alarms and control functions are operable and set appropriately;
- Check of all control and SCADA links, alarms and set points.

**3.2 Wet Commissioning**

3.2.1 The Wet Commissioning process will follow on from pre-commissioning, once it is verified that all the components of each sub-system have been fully pre-commissioned.

3.2.2 On completion of the pre-commissioning of sub-system components, the equipment within the sub-system will be set to operate as far as is practicable to confirm reliable operation on either potable water or plant service water.

3.2.3 Each piece of equipment will be required to operate for a minimum of 48 hrs.
3.2.4 All necessary temporary equipment including pumps, hoses and temporary control systems required to simulate feed to the plant inlet works shall be provided.

3.2.5 The following items shall be monitored during the unit test:

- Process timing sequences will be evaluated and adjusted to suit the dynamic requirements, where possible;
- Where appropriate, the equipment will be operated in AUTO and be adjusted via the SCADA system;
- Automatic duty changeover where appropriate;
- Response to imposed disruptions in operating points and requirements across the full design operating range;
- Current draw and operational performance of all mechanical equipment;
- Operation under relevant control modes.

3.2.6 The components of each system will be brought on-line and tested as a system to confirm that the system performs as required.

3.2.7 Each process unit shall be tested over its full range of operating conditions. The performance of each process system and sub-system shall be determined so that the system operation can be assessed for compliance with design criteria. Any non-compliance shall be rectified.

3.2.8 The wet commissioning shall include the following tasks:

- Adjustment of equipment and control settings;
- Site Acceptance Testing (SAT) of the PLC/SCADA software;
- Testing of continuous operation;
- Modifications and testing as required;
- The operation of mechanical, electrical and control systems under process conditions that represent the anticipated operating conditions;
- Plant start-up and shutdown testing;
- Operation of all auxiliaries / standby equipment;
- Method of isolation of plant equipment for safe shut down and maintenance procedures including as a minimum HV station and unit that supplies fire protection systems;
- Demonstration of the operator after hours call out systems.

3.2.9 The PLC/SCADA SAT shall include:

- Tuning of control loops;
- Checking of all interlocks and control logics including any modifications required;
- Testing of start-up and shutdown of the system.

3.2.10 Commissioning Workpacks shall be prepared including CMSs, ITPs and ITCs for each Plant sub-system.
3.2.11 The structure and contents of a commissioning workpack is explained in Section 4.1 of this Specification, along with documentation and quality recording requirements.

3.2.12 All Commissioning Workpacks shall be submitted to the Client’s Superintendent at least 28 days prior to commencing wet commissioning for review and approval, including the required Client witness and hold points.

3.2.1 Equipment Performance Testing

3.2.1.1 Equipment performance testing is the process of proving that all supplied equipment meets the requirements of the design or performance guarantees provided by the suppliers. Each major piece of equipment shall undergo a Site Acceptance Test (SAT) to verify that the equipment operates under the full range of operating conditions and meet the performance requirements.

3.2.1.2 Detailed testing protocols and acceptance criteria for key equipment shall be developed and agreed with the Superintendent following equipment selection.

3.2.1.3 Where equipment warranties or performance guarantees cannot be demonstrated, they will be added to the Defects and Omissions Punchlist and shall be verified during process commissioning. Any non-compliance shall be rectified.

3.3 Completion of Wet Commissioning

3.3.0.1 Upon completion of wet commissioning activities that form part of the Principal Contractor's scope, control of the Plant (or sub-system) will be handed over from the Principal Contractor to the Unitywater. Handover of Plant to Unitywater is subject to the following conditions:

i. Commissioning Workpacks are completed and closed including all Inspection and Test Check sheets (ITC);

ii. All Punchlist items categorised “A” and “B” are closed;

iii. The Plant is deemed to be wet commissioned and sewage can be introduced into the Plant;

iv. All handover deliverables have been received and accepted by UwP.

3.3.0.2 Upon handover to Unitywater, the Plant (or sub-system) will be under control of Unitywater and the following applies:

i. Access to the area is controlled by Unitywater;

ii. All commissioning activities will be coordinated by the Unitywater Major Projects Commissioning Team;

iii. The Principal Contractor Project Manager must gain permission from the Unitywater Lead Commissioning Engineer before programming any further construction or other activities which will affect the operation of the Plant;

iv. The Project Safety Management Plan remains in effect however all responsibilities detailed in the Project Safety Management Plan will be assigned to Unitywater Major Projects staff.

3.3.0.3 Members of the Contractor’s Team such as PLC programmers and instrumentation technicians shall assist in commissioning as required by the Unitywater Commissioning Team.
3.3.1 Defects and Omissions Punchlist

3.3.1.1 A consolidated Defects and Omissions Punchlist will be generated prior to and maintained throughout the commissioning process to keep a comprehensive list of all items that will affect commissioning, operation and handover of the plant.

3.3.1.2 Each item will be recorded including a classification on when it is to be resolved. The classifications are:

- Category A: Items to be rectified prior to pre-commissioning;
- Category B: Items to be rectified prior to Handover to Unitywater;
- Category C: Items to be rectified prior to Practical Completion.

3.3.1.3 Defects identified after Practical Completion will be managed according to the requirements of the Contract.

3.4 Process Commissioning

3.4.0.1 Process Commissioning is the process of introducing sewage into the Plant, establishing the biological treatment and testing the operation of overall Plant process.

3.4.0.2 Process Commissioning of the Plant shall include the following:

- Commissioning of the works as a complete process on sewage;
- Establishment and stabilisation of the biological treatment process;
- The operation of mechanical, electrical and control systems under process conditions that represent the anticipated operating conditions;
- Plant start-up and shutdown testing;
- Operation of all auxiliaries / standby equipment;
- Final adjustment of equipment and control settings;
- Final tuning of control loops;
- Final checking of all interlocks and control logics including any modifications required;
- Final checking of all equipment and the sewage treatment plant operation;
- Testing of continuous operation;
- Performance testing to establish that the operation of the Plant conforms with the specified requirements and the design intent;
- Preliminary testing to confirm that the Plant is capable of meeting the requirements of the Process Performance Test;
- Final training of operators and demonstration of maintenance activities;

3.4.0.3 All relevant information and experiences gained during these tests, including readings such as flow, effluent quality, noise, odour, vibration, power draw, shall be integrated into Unit Process Guidelines (UPGs), Standard Operating Procedures (SOPs), Functional Design Specifications, the Operations and Maintenance Manuals and drawings, including P&I Diagrams.
3.4.0.4 A list of control and instrument set points and alarm signal settings which have been determined during the successful operation of the plant will be included in the Functional Design Specifications. A complete list of all the parameters and settings for electrical drives and starters shall also be provided by the principle contractor, indicating where the default value has been changed.

3.4.0.5 A Process Commissioning Workpack shall be prepared including a CMS, ITP and ITC similar to those used in wet commissioning to document the Process Commissioning stage. Commissioning documentation and quality recording requirements are detailed in Section 4.1 of this Specification.

3.5 Process Performance Test

3.5.0.1 A twenty eight (28) day Process Performance Test shall be conducted at the end of process commissioning to demonstrate that the plant meets the output specification set out in the Project Brief. At this time, depending on Contractual arrangements, the process will be run by the Principal Contractor or Unitywater Treatment Plant Operations under the direction of the Unitywater Major Projects team. Responsibility for plant performance will stay with the Unitywater Major Projects Lead Commissioning Engineer until the plant performance requirements are met.

3.5.0.2 The Treatment Plant Operations Team will generally run the Plant, under the Unitywater Major Projects Lead Commissioning Engineer’s supervision, following the UPGs and SOPs.

3.5.0.3 An Inspection and Test Plan (ITP) shall be prepared for the Process Performance Test prior to the commencement of the test and within the required timing as set out in Section 3.8 of this Specification.

3.5.0.4 The ITP shall include:

- Test Program;
- Test Standards;
- Description of instrumentation to be used;
- Method of data recording.

3.5.0.1 A Process Performance Test Report shall be prepared on the completion of the test, outlining the results of all testing and including:

- Tables, graphs and calculations necessary for interpretation of the results;
- Comparison of results with guarantee requirements;
- SCADA printouts detailing any alarms and reliability of equipment;
- Discussion on overall performance of equipment.

3.6 Practical Completion

3.6.0.1 Where the Contractor’s responsibility is limited to delivery of a sub-system or system components, practical completion may be achieved upon conclusion of Wet Commissioning of that sub-system. However, where the Principal Contractor is responsible for demonstrating performance of the plant process, practical completion may be achieved upon conclusion of Process Performance Testing.
3.6.0.2 Practical completion is subject to provision and acceptance by UwP of all handover deliverables (documentation and other).

**3.6.1 Work on Equipment after Practical Completion**

3.6.1.1 Any access to equipment by Contractor personnel after Practical Completion shall be approved by the Unitywater Project Manager or their representative. Work shall be done in accordance with the Project Safety Management Plan.

**3.7 Handover to Unitywater**

3.7.0.1 Final commissioning completion and handover to Unitywater will occur after successful completion of the Process Performance Test and all commissioning completion criteria, as defined in Section 1.2, have been satisfied.

**3.8 Target Dates for Commissioning Related Activities**

3.8.0.1 The table below outlines the time frames for submission of major documents and achievement of commissioning milestones.

<table>
<thead>
<tr>
<th>Table 1 – Target Dates for Commissioning Related Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task</strong></td>
</tr>
<tr>
<td>Submission of Contractor Commissioning Plan</td>
</tr>
<tr>
<td>Commissioning risk workshop</td>
</tr>
<tr>
<td>Submission of software FAT Checksheets</td>
</tr>
<tr>
<td>Factory Acceptance Testing of PLC/SCADA Software</td>
</tr>
<tr>
<td>Submission of Pre-Commissioning ITP's</td>
</tr>
<tr>
<td>Submission of Wet Commissioning CMSs, ITPs and ITCs</td>
</tr>
<tr>
<td>Completion of Wet Commissioning</td>
</tr>
<tr>
<td>Submission of completed Wet Commissioning Workpacks</td>
</tr>
<tr>
<td>Equipment Performance Testing</td>
</tr>
<tr>
<td>Practical Completion</td>
</tr>
</tbody>
</table>
4. Commissioning Information Management

4.1 Commissioning Documentation and Quality Control

4.1.0.1 All commissioning documentation and records for the commissioning of a system shall be contained in that system’s commissioning Workpack. The definitions of Commissioning Workpacks for commissioning activities are detailed in this section.

4.1.0.2 Commissioning Workpacks shall be submitted to the Client’s Superintendent at least 28 days prior to commencing wet commissioning for review and approval, including the required Client witness and hold points.

4.1.0.3 The Table below is an example of a detailed breakdown of a plant into the relevant commissioning Workpacks.

<table>
<thead>
<tr>
<th>Number</th>
<th>System Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>Process Commissioning (by Unitywater Major Projects)</td>
</tr>
<tr>
<td>0100</td>
<td>Service Water System</td>
</tr>
<tr>
<td>0400</td>
<td>General Purpose Pump Station</td>
</tr>
<tr>
<td>0500</td>
<td>Storm Water System</td>
</tr>
<tr>
<td>0700</td>
<td>Odour Control System</td>
</tr>
<tr>
<td>0800</td>
<td>Nutrient Storage &amp; Dosing System</td>
</tr>
<tr>
<td>1000</td>
<td>Inlet Works &amp; Flow Balancing</td>
</tr>
<tr>
<td>3000</td>
<td>Bioreactor (Secondary Treatment)</td>
</tr>
<tr>
<td>3600</td>
<td>Clarification</td>
</tr>
<tr>
<td>4000</td>
<td>Biosolids Handling</td>
</tr>
<tr>
<td>5100</td>
<td>Sodium Hypochlorite Storage &amp; Dosing System</td>
</tr>
<tr>
<td>5200</td>
<td>Alum Storage &amp; Dosing System</td>
</tr>
<tr>
<td>6000</td>
<td>Disinfection</td>
</tr>
</tbody>
</table>

4.1.0.4 The Figure below is an example of the hierarchy of commissioning Documentation.
4.1.0.5 The following shows the typical Commissioning Workpack structure. This structure may vary depending on the particular system:

- Commissioning Method Statement;
- Safe Work Method Statements (SWMS);
- Punchlist;
- System ITP;
- Sub-system 1 ITP and ITC;
- Sub-system 2 ITP and ITC;
- Sub-system X ITP and ITC;
- Control System Site Acceptance Test Records (SAT);
- P&ID’s – System P&ID’s defined in the CMS;
- Supporting Documents – reports, registers, schedules, calibration records, supplier documents, etc.;
- Reference Documents – UPG/SOP/O&M.

4.1.0.6 All commissioning documents shall be numbered and named according to Unitywater’s Specification for Drawing, Document and Equipment TAG Numbering (Pr8843).
4.1.1 Commissioning Method Statements

4.1.1.1 Commissioning Method Statements (CMS) must be prepared in relation to a specific System/Sub-system. The CMS will cover the activities conducted during Commissioning.

4.1.1.2 A CMS should be prepared using the example shown in Appendix B. Commissioning Method Statements should generally be formatted to this style however, it should be noted that the paragraph headings may vary depending on the content of the Workpack.

4.1.1.3 The preparing staff member shall consider the following:

- **Title Page** Including revision number, approval date and the details of verification by the Independent Verifier;
- **Abbreviations** Particular to the system being commissioned;
- **Scope** Definition of the system being commissioned including referencing the relevant P&ID's, (a list of equipment is to be contained in an appendix);
- **Reference documentation** Lists the documents that form the Commissioning Workpack;
- **Commissioning Methodology** Methodology to be utilised during the commissioning activity, including the Work Warranties objectives, pre-requisites, interfaces with other systems and commissioning sequence;
- **Safety** References the relevant safety management plans and details the particular issues respective to the system being commissioned, typically, occupational risks, handling, storage or dosing of chemicals, overflows, etc.;
- **Environmental Considerations** References the relevant environmental management plans and details the particular issues respective to the system being commissioned, typically, stormwater, discharge, noise, etc.;
- **Other Considerations** Details particular issues respective to the system being commissioned, typically, temporary installations, concrete durability, corrosion control, contamination, etc.

4.1.2 Inspection and Test Checksheets

4.1.2.1 Inspection and Test Checksheets should be prepared in relation to a specific System. The scope of the activities being considered shall first be established to enable the ‘boundaries’ of the commissioning ITC to be defined. Following this, the wet commissioning ITC shall be compiled in a logical sequence to bring the system online, taking into consideration the following:

i. **Construction Completion** -
   - Assessment of construction Mechanical, Electrical and Instrument Workpacks for completion and where not completed assessment to ensure outstanding work will not impact commissioning activities.
ii. Preliminary Checks -
- Preliminary Checks to be conducted in the process area;
- PLC / SCADA control FAT documentation;
- PLC / SCADA software installed;
- Subcontractor pre-commissioning activities completed;
- Check availability of proprietary equipment O&M documentation;
- Check availability of Work as Executed drawings;
- Draft UPG & SOP;
- Calibration certificates for equipment and instruments used during testing;
- Where applicable confirmation that any regulatory certificates or approvals are in place;

iii. Filling and Flushing -
- Filling and flushing sequence;
- Required inspection of pipes and tanks;

iv. Equipment Testing -
- Depending on the type of equipment, testing can be conducted at different steps of commissioning;
- Critical parameters to be measured and watched to ensure the ‘Works’ is running correctly;

v. Wet Commissioning -
- Wet Commissioning Sequence;
- Equipment Testing. Depending on the type of equipment, testing can be conducted at different steps of commissioning;
- PLC / SCADA SAT;
- Subcontractor commissioning checks have been performed;
- Performance criteria;
- Critical parameters to be measured and watched to ensure the “Works” is running correctly;
- Check of safety interlocks;
- Subcontractor commissioning activities;
- Recording of software set points and process parameters;

vi. Finalisation -
- Completion of the PLC/SCADA SAT
- Update of UPG’s and SOP’s ‘As Constructed’;
- Update of FDS ‘As Constructed’;
Update of P&ID’s ‘As Constructed’.

4.1.2.2 At the relevant sections of the ITC outstanding HAZOP and Design actions required to be completed during commissioning shall be included.

4.1.2.3 The ITC shall provide a sequential listing of the inspections and tests required for the commissioning activities.

4.1.2.4 During the commissioning of the sub-system, the sequence of inspections and test may be altered to suit the particular installation, the status of associated systems or to optimise the operation.

4.1.3 Inspection and Test Plans

4.1.3.1 Commissioning ITP’s will be a summary sign-off sheet for their respective ITC’s. An ITP, based on the ITC, will list the sections and key elements of the associated ITC, the relevant references, acceptance criteria and provides the record of acceptance by related parties. Each item within the ITP will have nominated surveillance, witness and hold points.

4.1.3.2 An example extract from an ITP is shown in the figure below. The ITP contains each section of the ITC for signoff together with key inspections or checks which require surveillance, witness and / or hold points for release by Unitywater, identifying the relevant references and acceptance criteria.

Table 3 - Example ITP Structure

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ACTIVITY</th>
<th>REFERENCE DOCUMENT</th>
<th>ACCEPTABLE CRITERIA</th>
<th>INSPECTION CHECKS AND HOLD POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
</tr>
<tr>
<td>1.00</td>
<td>Construction Completion</td>
<td>CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
<tr>
<td>2.00</td>
<td>Preliminary Checks</td>
<td>CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
<tr>
<td>3.00</td>
<td>Filling and Flushing</td>
<td>CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
<tr>
<td>4.00</td>
<td>Wet Commissioning</td>
<td>CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
<tr>
<td>4.08</td>
<td>PMP0001 performance test</td>
<td>Section 4.08 of CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
<tr>
<td>4.09</td>
<td>PMP0002 performance test</td>
<td>Section 4.09 of CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
<tr>
<td>5.00</td>
<td>Finalisation</td>
<td>CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
<tr>
<td>5.02</td>
<td>Software SAT</td>
<td>Section 5.02 of CRYSTP-B-IC-0001</td>
<td>This section of the ITC has been completed</td>
<td>R</td>
</tr>
</tbody>
</table>

4.1.3.3 ITP and ITC numbers should follow Unitywater’s specification for Drawing, Document and Equipment TAG Numbering, UWDSTD-D-PX-0001, to assist in the management of quality records.
4.1.3.4 Inspection and Test Plans should be prepared as per example shown in Appendix C. ITPs should generally be formatted to this style however, it should be noted that the activities may vary depending on the content of the Workpack.

4.1.4 Unitywater Signoff

4.1.4.1 For pre-commissioning and wet commissioning, progressive witnessing and signoff by Unitywater Major Projects of commissioning activities / documents and staged closeout of commissioning Workpacks system by system will reduce delays in final acceptance and Practical Completion.

4.1.4.2 Each ITP shall have a signoff column for both Unitywater Major Projects and Unitywater Treatment Plant Operations. Surveillance, Witness or Hold points shall be nominated for each step of the ITP and for both parties.

4.1.4.3 At least three (3) business days’ notice shall be provided for every test which has been nominated as a Witness or Hold point for Unitywater Major Projects or Unitywater Treatment Plant Operations signoff.

5. Handover Deliverables

5.0.1 Handover deliverables comprise of documentation including Operations and Maintenance Manuals and other deliverables including Operator training information, Asset Registration sheets and copies of ‘As Commissioned” PLC/SCADA software. The required deliverables include records from both the Design and Construction phases of the Project.

5.0.2 All handover deliverables and documents shall be numbered and named according to Unitywater’s Specification for Drawing, Document and Equipment Tag Numbering.

5.0.3 All documents shall be provided as electronic editable copies except for generic equipment manufacturer’s manuals not specifically produced for the project.

5.1 Handover Documentation

5.1.1 General Introduction and Process Overview

5.1.1.1 A General Introduction to the Plant and a Process Overview shall be provided covering, at minimum, the following:

Scope;
Process Overview;
Staging;
Plant Specifications;
Capacity.

5.1.2 Unit Process Guidelines

5.1.2.1 Unit Process Guidelines (UPGs) must be provided for all main Plant Areas as defined by Unitywater’s Specification for Drawing, Document and Equipment Tag Numbering including the PLC and SCADA system. The UPGs provide a process overview for the operations staff to effectively understand and operate that unit process. Each UPG will
have a number of Standard Operating Procedures (SOPs) to support the operation of that process.

5.1.2.2 In general, a UPG shall detail:

- The objectives and function of the process unit and its relationship with the other processes;
- The components/equipment of the process unit;
- The principals of operation;
- The process control strategy;
- The key set points and limiting factors; and
- A trouble shooting guide.

5.1.2.3 The UPGs shall be prepared from the design documentation, equipment supplier information, process descriptions, functional descriptions and other reference material where required. The ‘As Constructed’ UPGs shall be provided at the time of Practical Completion, reviewed and approved by Unitywater.

5.1.2.4 UPGs developed prior to process commissioning must be updated with any changes made during process commissioning, optimisation or performance testing.

5.1.3 Standard Operating Procedures

5.1.3.1 Standard Operating Procedures (SOPs) shall be prepared for all Plant Sub-Areas as defined by Unitywater’s Specification for Drawing, Document and Equipment Tag Numbering (Pr8843). The purpose of the SOP is to provide a detailed step-by-step instruction to operate the process effectively and safely.

5.1.3.2 The SOP must contain:

- A brief description of the procedure;
- The scope of the procedure;
- Define the responsibilities of the Operator;
- Specify the conditions and standards to be used;
- Specify the tasks to be carried out;
- Identify the hazards and control measured associated with the procedure.

5.1.3.3 The SOPs shall be prepared from the design documentation, equipment supplier information, process descriptions, functional descriptions and other reference material where required. The ‘As Constructed’ SOPs shall be provided at the time of Practical Completion, reviewed and approved by Unitywater.

5.1.3.4 SOPs that are developed prior to process commissioning must be updated with any changes made during process commissioning, optimisation or performance testing.
5.1.4 Functional Description
5.1.4.1 An Electronic, editable, as constructed copy of the Functional Description must be provided as part of the handover deliverables.

5.1.5 Functional Specification
5.1.5.1 An Electronic, editable, as constructed copy of the Functional Specification including copies of all PLC and SCADA projects must be provided as part of the handover deliverables.

5.1.6 PLC and SCADA Manual
5.1.6.1 An Electronic, editable, as constructed copy of the PLC and SCADA Manual must be provided as part of the handover deliverables.

5.1.7 HAZOP/CHAZOP Reports
5.1.7.1 Electronic copies of Hazard and Operability Study Reports must be provided.

5.1.8 Vendor Manuals (Proprietary Equipment O&M Manuals)
5.1.8.1 Vendor Manuals must be provided for all mechanical and electrical equipment supplied under the contract. The manuals shall contain an index and shall be sorted in ascending order according to the Tag number.

5.1.8.2 Every item of equipment that has a tag number shall be included in this manual. A covering page shall be provided for all equipment which includes all details necessary to distinguish it from others. Where the same manual is applicable to multiple tag numbers the original shall be inserted behind the cover page of the first instance. All subsequent instances can include a reference to that location. The indexed manuals shall be provided as files in an appropriate folder structure.

5.1.8.3 Manuals for major equipment and ancillary equipment shall be provided as individual files. Naming and numbering of files and folders shall be undertaken in accordance with Unitywater’s Specification for Drawing, Document and Equipment Tag Numbering. All documents written by the Principal Contractor or equipment manufacturer specifically for the project (i.e. not a generic manual) shall be provided in an editable format. All other documents shall be provided as native pdf files. Scanned documents are not acceptable.

5.1.8.4 The information to be supplied includes, but is not limited to, the following (where applicable):

- Name of Supplier;
- Address and Telephone Numbers for Service Calls;
- Description – a full description of the equipment with a tabulation of specifications, dimensions and performance ratings;
- Technical Data – a copy of the Technical Data Sheet supplied by the manufacturer; reliability data (MTBF, MTTR and Reliability Block Diagram) shall be provided for each equipment type (where applicable);
- The equipment manufacturer’s operation and maintenance manual/s;
- Instrument Data Sheets;
Principles of Operation – a basic working description, including novel features and any automatic control;

Maintenance Procedures – step-by-step procedure for preventative maintenance work to be carried out at various intervals;

Spare Parts – a list of Vendor recommended spare parts;

Test Data and Troubleshooting – instructions to qualified tradesman for assessing and operational performance of the equipment;

Installation and Commissioning Instructions – details of Standards and procedures for mounting or erecting, wiring and lubricating the equipment; the commissioning instructions shall include step-by-step procedures for checks before the first start, first start, and checks after starting and operational tests;

Vendor supplied drawings.

5.1.9 Vendor Recommended Maintenance Routines & Spares

5.1.9.1 The Principal Contractor shall develop Maintenance Routines sufficient information for maintenance of all equipment. The recommended maintenance routines and spares shall be a summary of maintenance related information extracted from Vendor Manuals.

5.1.9.2 The information included in the Vendor Recommended Maintenance Routines and Spares shall include the following:

- Summarised table of manufacturer recommended preventative maintenance routines for all equipment including spares, maintenance frequency, task and details on consumables (see example below).

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Tag No</th>
<th>Recommended Spares</th>
<th>Maintenance Frequency</th>
<th>Task</th>
<th>Other Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>KSB Submersible Pump</td>
<td>UPA 150C</td>
<td>PMP-101</td>
<td>Seal Bearing</td>
<td>4,000 hrs</td>
<td>Check motor resistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,000 hrs</td>
<td>Lubricate bearings</td>
<td>SAE 15W40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 Years</td>
<td>Overhaul</td>
<td></td>
</tr>
</tbody>
</table>

5.1.9.3 All equipment with Vendor recommended maintenance routines and/or spares shall be included in the summary table.

5.1.10 Statutory Certifications

5.1.10.1 A register of Statutory Certifications shall be compiled.

5.1.10.2 The register shall contain an index page and is to be provided in as individual files in an appropriate file structure. Statutory Certifications may include:

- Dangerous goods;
- Hazardous areas;
- Pressure vessels;
• Lifting gear;
• Building Approvals.

5.1.11 Warranty Register

5.1.11.1 Warranty documentation shall be compiled for all components supplied with manufacturer's warranties.

5.1.11.2 The warranty register shall contain an index page and is to be provided as individual files in an appropriate file structure.

5.1.12 Process Performance Test Report

5.1.12.1 A Process Performance Test Report shall be prepared on the completion of Process Performance Testing, outlining the results of all testing. The report shall include:

• Tables, graphs and calculations necessary for interpretation of the results;
• Comparison of results with guarantee requirements;
• SCADA printouts detailing any alarms and reliability of equipment;
• Discussion on overall performance of equipment.

5.1.13 Final Commissioning Report

5.1.13.1 A commissioning report shall be submitted at the end of the Process Performance Test. The completed and agreed report will be filed for future reference when operating the plant.

5.1.13.2 The report will include or refer to:

• The Contractor's Commissioning Plan;
• Completed Commissioning Workpacks;
• Calibration reports;
• Flows, pollutant loads, chemical and power consumption;
• Copies of Test Certificates;
• Comments should be included on any observed deficiencies in plant equipment design and performance;
• Any conclusions that would be helpful to operating and maintenance staff can be summarised at the end of the report;
• Copies of the weekly reports and weekly meeting minutes.

5.1.14 Training Records

5.1.14.1 All training packages shall be prepared and supplied as part of the handover documentation to enable future training of new personnel and refresher training as required. Each package shall include all associated material including PowerPoint files, training manuals and models, etc. Attendance sheets and training competency assessments shall also be provided as part of the training packages.
5.1.15 ‘As Constructed’ Drawings

5.1.15.1 ‘As Constructed’ Drawings shall be prepared in accordance with Unitywater’s Specifications and the Contract requirements.

5.1.15.2 Drawings must be prepared for each of the following disciplines:

- Civil;
- Electrical;
- Mechanical (incl. piping);
- General:
  - P&IDs;
  - Process Flow Diagrams (PFDs);
  - Hydraulic Grade Diagrams;
  - Mass Balances;
  - Site Plans (Hazardous Areas, Fire Extinguishers, Switchboards).

5.1.15.3 Drawings shall be provided in the following format:

- Electronic – grouped by Discipline and Process Area (in accordance with Specification for Drawing, Document and Equipment TAG Numbering) and supplied in both CAD and PDF formats;
- Hard copies – to be identified with stakeholders what drawings are required in hard copy, the number and paper size (note that hard copies are generally not required with exception to drawings located at switchboards to satisfy electrical regulations).

5.1.16 Compilation of Final Handover Documentation

5.1.16.1 All handover deliverables must be compiled the format as required by the Contract.

5.1.17 Handover Documentation Index

5.1.17.1 A quick reference to all handover documentation shall be provided. The Index will be produced in Microsoft Excel or HTML format with hyperlinks to all handover documentation. A typical handover documentation structure is provided in Annex E.

5.2 Other Handover Deliverables

5.2.1 Operator Training

5.2.1.1 Training of the Treatment Plant Operations and Maintenance personnel will be undertaken throughout the commissioning phase. Unitywater Treatment Plant Operations (Treatment Technologies) personnel will work as part of the Commissioning Team; therefore some of the training will occur through an on-the-job approach.

5.2.1.2 Formal training shall be provided to the Treatment Plant Operations and Maintenance personnel including PowerPoint presentations and handouts on:

- Key equipment,
- Electrical systems
5.2.1.3 Training shall also be provided on the process and Unit Process Guidelines. The UPG training shall include technical, process, specialist equipment and SCADA knowledge transfer.

5.2.1.4 Training shall be coordinated in conjunction with the UWP Lead Commissioning Engineer. Formal training dates shall be requested 2 weeks in advance. Unitywater Treatment Plant Operations and Maintenance Leads will confirm the date and supply names and discipline on attendees within a week of the training request.

5.2.1.5 Unitywater Major Projects will assess the adequacy of the training on a regular basis.

5.2.2 Asset Registration

5.2.2.1 The capture of new assets or changes to the status of existing assets is necessary for the following reasons:

- Enable servicing or maintenance on new assets
- Cease servicing or maintenance of old assets
- Capitalise and commence depreciation of new assets
- Write off disposed assets

5.2.2.2 Asset Capture templates will be made available to aid in understanding the general requirements that may form part of the contract as it pertains to asset capture.

5.2.2.3 Final templates will be provided by the Unitywater Asset Management Officer following design phase. The asset capture template will include a full list of existing assets to enable the capture of changes to the status of those assets resulting from the project.

5.2.2.4 Spares must be included in the asset capture templates.

5.2.2.5 Asset registration must be finalised prior to commencement of Process Commissioning as Unitywater is typically required to maintain equipment during this phase.

5.2.3 PLC/SCADA Assistance

5.2.3.1 In addition to the training provided on the PLC/SCADA systems, 24 hour assistance shall be available during early operation of the systems (familiarisation period) by Unitywater.

5.2.4 Electronic Records

5.2.4.1 A copy of all software used for PLCs and SCADA shall be provided. The version of the software must be the version used during final commissioning and be clearly annotated.

5.2.4.2 A copy of all training videos must also be provided as part of the Training Records (refer Section 5.1.14).
### Annexe A. Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMS</td>
<td>Commissioning Method Statement</td>
</tr>
<tr>
<td>DBB</td>
<td>Design, Bid, Build (Contract Type)</td>
</tr>
<tr>
<td>D&amp;C</td>
<td>Design and Construct (Contract Type)</td>
</tr>
<tr>
<td>DLP</td>
<td>Defects Liability Period</td>
</tr>
<tr>
<td>FAT</td>
<td>Factory Acceptance Test</td>
</tr>
<tr>
<td>FD</td>
<td>Function Description</td>
</tr>
<tr>
<td>ITC</td>
<td>Inspection and Test Checksheet</td>
</tr>
<tr>
<td>ITP</td>
<td>Inspection and Test Plan</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>OH&amp;S</td>
<td>Occupational Health and Safety</td>
</tr>
<tr>
<td>PC</td>
<td>Principal Contractor</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
</tr>
<tr>
<td>P&amp;ID</td>
<td>Process and Instrumentation Diagram</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
</tr>
<tr>
<td>SAT</td>
<td>Site Acceptance Test</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>STP</td>
<td>Sewage Treatment Plant</td>
</tr>
<tr>
<td>UPG</td>
<td>Unit Process Guideline</td>
</tr>
<tr>
<td>UWP</td>
<td>Unitywater Major Projects</td>
</tr>
<tr>
<td>UWTPO</td>
<td>Unitywater Treatment Plan Operations (Treatment Technologies)</td>
</tr>
<tr>
<td>WMS</td>
<td>Work Method Statement</td>
</tr>
</tbody>
</table>
Annexe B. Example CMS

1. Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITC</td>
<td>Inspection Test Checksheet</td>
</tr>
<tr>
<td>ITP</td>
<td>Inspection Test Plan</td>
</tr>
<tr>
<td>SAT</td>
<td>Site Acceptance Test (for automated control system)</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>MSDS</td>
<td>Material Safety Datasheet</td>
</tr>
<tr>
<td>WRA</td>
<td>Workplace Risk Assessment</td>
</tr>
</tbody>
</table>

2. Scope

This commissioning method statement outlines the sequence of activities for the pre-commissioning and commissioning of the XXXXX. The pre-commissioning and commissioning sequence are detailed in the corresponding ITC. During commissioning of the XXXXX, certain sequence or setpoint may be altered to suit the particular installation or to optimise the system performance.

XXX is comprised of the following sub-systems or sections of the Cooroy STP Augmentation:

<table>
<thead>
<tr>
<th>Dwg No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(What process and to whom does this process apply)

3. Reference Documentation and Records

Detail the relevant pre-commissioning or commissioning documentation associated with commissioning this system:

- [Bullet list]
- [Bullet list]
4. Commissioning Methodology

4.1 Objectives

4.2 Pre-requisites

4.3 Other Systems

4.4 Sequence

5. Safety

5.1 SWMS

Prior to performing a commissioning task, the commissioning engineer must complete a Safe Work Method Statement detailing if isolation is required. The SWMS will be designed and reviewed by the lead commissioning engineer and checked against the Project Safety Management Plan.

5.2 Chemicals

The system contains diluted chemicals. Ensure that the proper PPE is worn and the MSDS for each chemical are nearby.

Prior to Chemical being delivered on site the commissioning engineer must ensure that:

- Chemical storage system is ready to receive chemical
- Safety equipments are operational
- Dangerous Goods licence was obtained

5.3 Overflows

The overflow is directed to XXXXX. Prior to commencing commissioning activities, the commissioning engineer must obtain a permit to work from the permit office and ensure that no work is ongoing or planned in.

6. Environmental Considerations

6.1 Storm Water system

6.2 Treated Effluent Release
Environmental Protection Licence (EPL) monitoring and reporting requirements must be in place at the Plant discharge point before any release to the wetlands.

6.3 Accidental discharges to the Environments

7. Other Considerations

7.1 Odour control

7.2 Noise Control

7.3 Corrosion

Care should be exercised at all times to stop damage to protective coatings which will lead to corrosion. If leaks do occur, they should be repaired and the area washed with freshwater as soon as possible. If leaks cannot be repaired easily, the leak should be contained to reduce the contact with other equipment.

7.4 Oil and Grease

During commissioning, extreme care must be given to prevent and or contain any oil leaks from equipment contaminating water. Leaking oil should not be released into the environment.
## Annexe C. Example Commissioning ITP

### INSPECTION & TEST PLAN

**COOROY STP AQUIMENTATION PROCESS COMMISSIONING**

<table>
<thead>
<tr>
<th>Task</th>
<th>Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SC - Sub contractor / Supplier</td>
</tr>
<tr>
<td></td>
<td>PC - Principle Contractor</td>
</tr>
<tr>
<td></td>
<td>UWP - Unitywater Major Projects</td>
</tr>
<tr>
<td></td>
<td>UWO - Unitywater Operations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ACTIVITY</th>
<th>REFERENCE DOCUMENT</th>
<th>ACCEPTABLE CRITERIA</th>
<th>INSPECTION CHECKS AND HOLD POINTS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SC</td>
<td>PC</td>
</tr>
<tr>
<td>1.00</td>
<td>Construction Completion</td>
<td>CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>H</td>
</tr>
<tr>
<td>2.00</td>
<td>Preliminary Checks</td>
<td>CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>W</td>
</tr>
<tr>
<td>3.00</td>
<td>Filling and Punching</td>
<td>CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>W</td>
</tr>
<tr>
<td>4.00</td>
<td>Wet Commissioning</td>
<td>CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>W</td>
</tr>
<tr>
<td>4.08</td>
<td>PH0001 performance test</td>
<td>Section 4.08 of CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>W</td>
</tr>
<tr>
<td>4.09</td>
<td>PH0002 performance test</td>
<td>Section 4.09 of CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>W</td>
</tr>
<tr>
<td>5.00</td>
<td>Finalisation</td>
<td>CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>M</td>
</tr>
<tr>
<td>5.03</td>
<td>Software SAT</td>
<td>Section 5.02 of CRYSTP-IP-00001</td>
<td>This section of the ICP has been completed</td>
<td>R</td>
<td>H</td>
</tr>
</tbody>
</table>
### Annexe D. Example Commissioning Checksheet (ITC)

#### COMMISSIONING CHECKSHEET

**COOROY STP AUGMENTATION**  
**WET COMMISSIONING**  
**SYSTEM: 0001 EXAMPLE**

The following checklist is to be followed during commissioning and testing of a Process System. Use “✓”, “×” or “N/A” (Not Applicable) in the “Result” column. If an “×” is placed next to an item detail the corrective action required. Each item is to be initialed and dated when task is performed or the corrective action completed. Add comments as necessary in the “Comments” column.

<table>
<thead>
<tr>
<th>System: LAMELLA THICKENER No.1</th>
<th>Data Sheet Completed:</th>
<th><strong>/</strong>/____</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item No.</strong></td>
<td>Test/Preparation Description</td>
<td>Pass</td>
</tr>
<tr>
<td>1.00 CONSTRUCTION COMPLETION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.01</td>
<td>Confirm that the civil installation has been completed and all A punchlist items have been closed out.</td>
<td></td>
</tr>
<tr>
<td> </td>
<td>Consider the impact of incomplete Work Packs on ability to safety commission this sub-system</td>
<td></td>
</tr>
<tr>
<td>1.02</td>
<td>Confirm that the mechanical installation has been completed and all A punchlist items have been closed out.</td>
<td></td>
</tr>
<tr>
<td> </td>
<td>Consider the impact of incomplete Work Packs on ability to safety commission this sub-system</td>
<td></td>
</tr>
<tr>
<td>1.03</td>
<td>Confirm that the Piping installation has been completed and all A punchlist items have been closed out.</td>
<td></td>
</tr>
<tr>
<td> </td>
<td>Consider the impact of incomplete Work Packs on ability to safety commission this sub-system</td>
<td></td>
</tr>
<tr>
<td>1.04</td>
<td>Confirm that the electrical installation has been completed and all A punchlist items have been closed out</td>
<td></td>
</tr>
<tr>
<td> </td>
<td>Consider the impact of incomplete Work Packs on ability to safety commission this sub-system</td>
<td></td>
</tr>
<tr>
<td>1.05</td>
<td>Complete a general walk through of this Sub-system within the limits of this and associated sub-systems required during commissioning of this sub-system.</td>
<td></td>
</tr>
<tr>
<td> </td>
<td>Consider impact, of any items found, on the ability to safely commission this sub-system</td>
<td></td>
</tr>
<tr>
<td>2.00 PRELIMINARY CHECKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.01</td>
<td>PLC pre-commissioning software installed</td>
<td></td>
</tr>
</tbody>
</table>

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## LAMELLA THICKENER No. 1

<table>
<thead>
<tr>
<th>Item</th>
<th>Test/Preparation Description</th>
<th>Pass</th>
<th>Comment or Correction Notes Std. No.</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.01</td>
<td>Pre-commissioning of Pumps. ITF's complete and attached for:</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- PMP0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- PMP0002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.02</td>
<td>Pre-commissioning of Valves. All valves associated with the sub-system ITF's completed and attached</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- VLV0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- VLV0002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.03</td>
<td>Pre-commissioning of Instrument including calibration. All instruments associated with the sub-system ITF's completed and attached</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- AT0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- AT0002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.04</td>
<td>Pre-commissioning of Misc. equipment. All other equipment associated with the sub-system ITF's completed and attached</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- TNK0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- TNK0002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.05</td>
<td>Check that the FAT software checksheets &amp; ITF's are complete for this system</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.06</td>
<td>Automatic control software is installed if it differs from the pre-commissioning software</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.07</td>
<td>Check that the sub-system SCADA set-points have been set in accordance with the instrument schedule (MERAM/Lite)</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.08</td>
<td>Confirm availability of proprietary equipment O&amp;M documentation</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Pr8874 - Commissioning and Handover Specification Treatment Plants

## LAMELLA THICKENER No. 1

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Test/Preparation Description</th>
<th>Pass</th>
<th>Comment or Correction Notes S/H, No.</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PMP0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M00001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.08</td>
<td>Confirm availability of As Constructed documentation</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2.09</td>
<td>Draft UPO's and SOP's available</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2.10</td>
<td></td>
<td></td>
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<td>2.11</td>
<td></td>
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<td></td>
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<tr>
<td>3.00</td>
<td>FILLING / FLUSHING</td>
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<td></td>
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<tr>
<td>3.01</td>
<td></td>
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</tr>
<tr>
<td>4.00</td>
<td>WET COMMISSIONING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.01</td>
<td></td>
<td></td>
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<td>4.04</td>
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## 5.05 FINALISATION

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5.01</td>
<td>All software setpoints have been recorded</td>
</tr>
<tr>
<td>5.02</td>
<td>The software SAT Checksheet has been completed. Attach the completed SAT of the functional Specification</td>
</tr>
<tr>
<td>5.03</td>
<td>Update of UFG’s and SOP’s “As Constructed”</td>
</tr>
<tr>
<td>5.05</td>
<td>Update of FDS “As Constructed”</td>
</tr>
<tr>
<td>5.06</td>
<td>Update of P&amp;ID’s “As Constructed”</td>
</tr>
<tr>
<td>5.07</td>
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Annexe E. Typical Handover Documentation Structure

Typical Handover Documentation (to Operations)

Statutory Certifications
- Dangerous Goods
- Hazardous Areas
- Pressure Vessels
- Lifting Gear
- Building Approvals

O&M Manual

Asset Register

Commissioning Information

As Constructed Drawings

Warranty Register

Design Report

Maintenance

Major Equipment Lists
- Valve
- Motor
- Mechanical Equipment
- Electrical Equipment
- Instrument
- Pipeline

Vendor Manuals

Vendor Recommended Maintenance Routines and Spares Parts List

Hazop Report

Operations Manual

Ladder Logic


Process Performance Test Report

Commissioning Report
- Check Sheets
- Equipment Performance Test Results
- 'As Commissioned' Information etc.

Ladder Logic

General Introduction & Process Overview
- Scope
- O&M Manual
- Philosophy
- Staging
- Plant Spaces
- Capacity etc.

Standard Operating Procedures (SOPs)

Unit Process Guidelines (UPGs)

Trainings Records

Electronic Records
- Software
- Training Videos etc.

Legend

Documents

Includes

Operations

As Constructed Drawings

Warranty Register

Pr8874 - Commissioning and Handover Specification Treatment Plants

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