

# O&M Manual and Operator Training Specification

AM2522

Version 2

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# 1 Document Control

## 1.1 Version History

Version	Issues	Description of version
1.0	10/10/13	Initial draft
2.0	3/10/13	Updated based on M&E comments

## 1.2 Sign Off and Authorisation


## 1.3 Purpose and Scope of the Document

This specification defines the general requirements for operation and maintenance manuals and operator training.

## 2 Operation and Maintenance Manual

Draft Operation and Maintenance manuals shall be submitted for comment by the Contractor under separate cover at least four weeks before commissioning of the system.

After the testing and commissioning of the works, the draft manuals shall be modified or extended by the Contractor where necessary to incorporate the test information and any further useful information or data obtained.

The information to be submitted shall fully comply with the requirements outlined below.

- The contractor shall provide 2 separately bound hard copies and 1 electronic copy on CD in pdf format of the Operation and Maintenance (O&M) Manuals for all the works under the Contract.
- The contractor shall supply a software copy of all the *word* files forming part of the O&M manual
- The contractor shall supply an electronic copy of all drawings in *dwg* format
- The O&M Manual developed by the Contractor shall specifically target the plant operators and maintenance staff as the readers and users.
- The manuals shall provide practical, readable text, clear tables, concise charts, easy to understand graphics and schematic figures, all specifically written in English for the equipment provided.
- Only information relevant to the equipment processes or systems, supplied in this Contract shall be included in the Manual.

Each manual shall be arranged into the following nine sections. Each section shall as a minimum contain the information described below.

### 2.1 Section 1 – General Description of Plant and Equipment

Section 1 of the O&M manual shall include as a minimum, the following information:

- General Information
  - Project Title
  - Scope of work under the contract
  - Name of the Equipment and Process Unit
  - Contractor and subcontractor details
  - Address and contact telephone numbers for spares and service calls
- The *design basis report* which should capture the rationale of decisions made from beginning to end of design
- Provides a basic working description of the equipment and the fundamental principles of operation
- Provide an overview of the new and/or modified PLC and telemetry systems for the project
- Provide an overview of the electrical distribution system for the project

### 2.2 Section 2 – Safety Precautions

Section 2 shall contain as a minimum general safety guidelines that workers must follow when operating and maintaining equipment. Safety precaution information shall include as a minimum:

- List of chemicals, gases and other hazardous substances
- Material Safety Datasheets (MSDS)
- Protective Personal Equipment (PPE)
- Fire and Safety Precautions
- Disposal Guidelines for chemicals and other hazardous materials
- Environmental Concerns
- Equipment Access for confined spaces
- Work methods for the safe removal of equipment or components that have been exposed to chemicals, gases or hazardous substances;

## 2.3 Section 3 – Plant Operation

Section 3 shall contain detailed information on how the equipment operates including:

- Detailed Functional Description
  - Detail the 'As Built' control philosophy which explains the control loops, automatic operating sequences, and all the various instrumentation and control functions for the project
  - Describe the automatic safety features, interlocks and procedures for each item of equipment, process unit or system.
  - Describe those parameters that must be maintained and monitored in order to operate the system efficiently and effectively
  - Describe control system alarms, the possible causes, and what can be done
- Provide a list of all 'As Commissioned' setpoint values including minimum and maximum setpoint values
- Explain what regular testing and monitoring programs are required for the equipment installed
- Provide easy to follow, step-by-step operating instructions including:
  - Checks before Starting
  - Start-up procedures
  - Checks after start-up
  - Operational Checks
  - Shutdown Procedures
  - Emergency Operation
- Provide Installation and Commissioning Instructions:
  - Details of standards and procedures for mounting or erecting, wiring, lubricating and alignment of equipment;
  - The commissioning instructions shall include step by step procedures for checks before commencing operation for the first time, the first start, checks after starting and operational tests.
- Provide a Troubleshooting Guide for the system:
  - Provide troubleshooting guides to assist the operator regain control of an out of control process.

## 2.4 Section 4 – Technical Data

Section 4 shall contain technical details for all components of the system including:

- Instrument schedule showing as a minimum:
  - Description

- Tag
- Type of instrument
- Make
- Model
- Normal operating condition
- Supply voltage
- Range of instrument
- Valve schedule showing as a minimum:
  - Description
  - Tag
  - Type of valve
  - Make
  - Model
  - Size of valve
  - Connection details
  - Materials of construction
- Equipment schedule showing as a minimum:
  - Description
  - Tag
  - Make
  - Model
  - Duty
  - Electrical rating and power
- Separate Data Sheets shall be provided for ALL:
  - Motors
  - Pumps
  - Transfer screws and conveyors
  - Gearboxes
  - Bearings
  - Mechanical seals.

Watershed templates for capturing technical data shall be completed and attached as an Appendix A to the O&M manual. The following watershed templates are available:

- PRS Asset Collection data sheet Electrical
- General Mechanical for Water PRS Assets
- Water PRS Mechanical Details
- M&E for Recycled water P.S Assets
- M&E for sewer P.S Assets s
- Electrical for Water P.S Assets
- Water P.S mechanical details
- Electrical for water storage assets
- Water storage mechanical details

Provide equipment manufacturer and Local representatives contact details

## 2.5 Section 5 – Routine and Preventative Maintenance

Section 5 of the O&M manual shall include as a minimum, the following details of routine and preventative maintenance, including inspections and cleaning, required for ensuring reliable and troubling free equipment operation:

- Preventive maintenance schedule for individual components of the equipment.
- Step-by-step procedures for routine and preventive maintenance (RPM), inspection and services needed to be carried out: daily, weekly, monthly, at six months and annually, or any other period recommended by the manufacturer for the equipment/system.
- Inspection and condition monitoring procedures to enable early detection of potential operation problems or failure.
- Service Procedures, repair manuals and instructions
- Include as a minimum, all details of the lubrication requirements for all routine and preventative maintenance and repair procedures, including:
  - Full specification details of all lubricants, including brand names and approved manufacturer's listing
  - Run hours to lubricant replacement
  - Drain procedure
  - Fill procedure.

## 2.6 Section 6 – Spare Parts and Special Tools

Section 6 of the O&M manual shall include as a minimum, details of all replaceable spare parts and special tools required for all routine and preventative maintenance and repair procedures, including:

- Full listing and specification details of spare parts, including:
  - Manufacturer's name
  - Model number
  - Serial number
  - Local agent contact details (i.e. name, address, telephone number, fax number, etc.)
- If applicable, the parts listing shall be further sub-divided into sub-components or subassemblies of large items
- Illustrations and Schedules for identification and specifications for all items in the equipment;
- Run hours to replacement
- Replacement procedure
- Supply any communication leads and software/licenses to connect to PLCs or VSDs or any other related electrical/instrument equipment

Include as a minimum, a full listing of any special tools or equipment that might be required to carry out routine or preventative maintenance, repair procedures, equipment adjustments or the replacement of any spare parts.

## 2.7 Section 7 – Supplier Manuals

Section 7 of the O&M manual shall include as a minimum supplier manuals for all equipment and hardware supplied under the contract including:

- Instruments
- Valves
- Equipment such as pumps and fans

- Pump, blower and fan curves

Supplier manuals do not need to be provided for equipment

- That is regularly used by South East Water
- Where the number of pages in the manual is great and it is available on line

## 2.8 Section 8 – Drawings

Section 8 of the O&M manual shall include as a minimum, a full set of drawings specific to the equipment including:

- A complete drawing list with the description and number of each drawing
- Piping and Instrumentation Diagrams (P&IDs)
  - Electronic copies of As built drawings to be provided in both CAD and pdf format
  - Hard copies to be included in O&M manual
- Electrical Single Line Drawings, Schematics and Control Panel Drawings
  - Electronic copies of As built drawings shall be supplied in CAD format only
  - Hard copies to be included in O&M manual
- General Arrangement Drawings (Civil and Mechanical)
  - Where minor changes exist between the design and what was built - As-built red pen mark ups will be accepted
    - Hard copy red pen mark-ups to be included in O&M manual
    - Electronic copies of IFC drawing set to be provided in both pdf and CAD (including necessary xrefs/support files)
  - Where major changes exist between the design and what was built a full as-built CAD package is required:
    - Hard copy drawings required in the O&M manual
    - Electronic copy to include pdf files and As-Con CAD package
- Civil as-con & Survey Data shall also be provided in electronic format

All electronic drawing copies are to have the asset number/project number/drawing number in the file name.

## 2.9 Section 9 – Test Data and Certificates

Section 9 of the O&M manual shall include a copy of test data and certificates including:

- Factory acceptance test results
- Site acceptance test results
- Calibration records for instruments and dosing pumps
- Variable Speed Drive (VSD) configuration files in electronic and hard copy
- Material test certificates
- Copies of manufacturer's warranties
- Certificates of compliance (if applicable)
- Noise and vibration test figures
- Inspection and Test Plans (ITP's)
- RTU/PLC programming files to be submitted in electronic copy

## Appendix A – Watershed Templates

### 3 Operator Training

Comprehensive formal training in the operation and maintenance of all equipment supplied shall be provided following successful commissioning.

The purpose of the training is to adequately and thoroughly teach the operators all aspects of operation and maintenance of the equipment/systems provided so that these personnel can reliably, effectively and safely operate the equipment.

The operator and maintenance training shall be conducted as separate sessions and as a minimum shall include:

- Both theoretical and practical aspects of the equipment, which shall include classroom and hands on lessons.
- Operational and process theory, mechanical and electrical operation, and instrumentation.
- All aspects of equipment maintenance, maintenance systems and equipment safety.
- All special techniques for checking, testing, adjusting, setting, calibrating and servicing the equipment, instruments, analysers and electrical and control systems.
- Operation of each item of equipment in automatic and manual modes.
- Operation and troubleshooting knowledge specific to each item of equipment.
- Normal and Emergency operations (including start-up and shutdown).
- Preventative and Routine Maintenance requirements.
- Spare parts requirements and use of any special tools.