

B-SPE-STD-007 Process Flow Diagram and Piping and Instrumentation Diagram Requirements

Document number: SPE-00351

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

Ver No.	Description	Document Owner		Document Approver		
		Position	Approval	Position	Approval	Approval Date
4	Amended Version	Team Leader Process & Analysis - P7404	Refer to supporting Info in Rex	Manager Service Delivery	Refer to supporting Info in Rex	16/03/2026

This Engineering Standard was endorsed by an RPEQ on behalf of Seqwater.

Version History

Ver	Date	Description	Author	SME	Owner	Approver
1	16/12/2016	First Issue				
2	02/03/2020	Minor updates				
3	10/02/2023	Minor updates				
4	17/03/2026	Minor updates				

(Refer Controlled Document in REX for Author, SME, Owner and Approver details)

Contents

1.	Purpose	5
2.	Scope	5
3.	Definitions	7
4.	Abbreviations	8
5.	Roles and Responsibilities	9
6.	Reference Documents	10
7.	Drawings Management	11
8.	Process Flow Diagram	11
8.1.	Purpose.....	11
8.2.	Content	12
8.3.	File Format, Layout and Legibility.....	13
8.4.	Updates to PFD's	13
9.	Piping and Instrumentation Diagrams.....	13
9.1.	General.....	13
9.2.	File Format, Revisions, Title Block and Legibility.....	14
9.3.	Drawing Arrangement	14
9.4.	Symbols, Legend & Typical Sheets	15
9.5.	Equipment, Valves, Instrumentation and Piping	15
9.5.1.	Equipment.....	15
9.5.2.	Motors	17
9.5.3.	Valves & Actuators	17
9.5.4.	Instrumentation.....	17
9.5.5.	Piping	18
9.5.6.	Process Safety Components & Non-operational Equipment	18
9.6.	Major Transmission Pipelines.....	19
9.7.	Process Control, Alarms & Safety Instrumented Functions	19
9.8.	Annotations & Off Page Connections	21
9.9.	Vendor Equipment	21
9.10.	Notes & Holds.....	22
9.11.	Utilities.....	22

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	3 of 22

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

10. Changes from previous version 22

11. Verification 22

12. Further Information..... 22

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	4 of 22

1. Purpose

This document is part of a suite of Seqwater Engineering Standards which are in alignment with the Seqwater Quality Management System. Their purpose is to provide a consistent approach to the development, modification, and management of Seqwater infrastructure that is fit for purpose, economic over the life of the asset, and meets Seqwaters risk appetite and compliance requirements including Work Health and Safety obligations.

This Standard Specification provides the minimum requirements for all Seqwater works where Process Flow Diagrams (PFD) and Piping and Instrumentation Diagrams (P&ID) are required.

This document must be used in conjunction with the documents it references to assist in ensuring fit for purpose infrastructure. This Standard Specification is not intended to be relied on solely for design, supply, and installation works; advice from specialist engineers and/or manufacturers may be required on a case-by-case basis.

In this Standard Specification the term “process unit” applies to both process and utility units. PFDs and P&IDs shall be prepared for process units, utility units and common facilities where such diagrams are appropriate. The requirements in this Standard Specification are independent of the tools with which the diagrams are produced.

2. Scope

This Standard Specification applies to all Seqwater employees, suppliers, contractors, and consultants working for, or on behalf of, Seqwater unless otherwise stated. It applies to all new assets and to all existing assets undergoing refurbishment or modification. It must be used in conjunction with other relevant Seqwater Engineering Standards and project specific documents to define the technical requirements for infrastructure design and construction.

Where single or discrete components of an existing non-compliant system are to be replaced, refurbished or modified, this standard should not automatically be applied to the entire system retrospectively, however consideration should be given, in consultation with relevant stakeholders, to the extent of the application of the standard outside of the components requiring replacement, refurbishment or modification, to ensure safe, economic, and fit for purpose infrastructure. Seqwater Engineering Standards include Standard Specifications, Drawings, Procedures, Templates, Forms and Preferred Equipment Lists. Together they detail Seqwater's minimum requirements and recommendations to provide infrastructure that will be fit for purpose, safe, and cost effective to operate and maintain. However, compliance with these requirements and recommendations does not remove, and cannot be relied on as meeting, the designer's overarching responsibility for ensuring infrastructure designed is fit for purpose and safe to construct, operate, maintain, and demolish. The designer must exercise appropriate due diligence to identify and manage hazards so far as is reasonably practicable.

Designers must also ensure compliance with relevant Australian Legislation, Standards, Codes and Guidelines (including those produced by Water Services Association of Australia). Where no Australian Standard exists for a particular application, work must conform to the most current version of an industry accepted international standard.

Deviation from meeting the minimum requirements in this Standard Specification requires written agreement from Seqwater as per the deviation process detailed in Procedure X-PRO-STD-008 Asset Standards Management and Application. That process includes completion of an X-TMP-STD-022 Asset Standards Deviation Request Form together with relevant supporting documentation, and submission by the Seqwater Project Representative to the

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	5 of 22

Seqwater Engineering Mailbox. Where noted in this Standard Specification that Seqwater approval, agreement, or acceptance shall/must be sought, such approval, agreement or acceptance must be gained through the Seqwater Asset Standard Deviation process, as outlined above.

Responsibility for ensuring compliance with Seqwater Engineering Standards lies with those engaged in the management and execution of design, construction, and modification of Seqwater infrastructure. This includes modifications to the functional design of the infrastructure including technical changes made which would extend an asset outside of its design operating envelope and/or approved operation and maintenance practices.

Any ambiguities or conflicts identified between specific requirements within this Standard and project documents, another Seqwater Engineering Standard or Australian Legislation, Standards, Codes or Guidelines, must be brought to the attention of the Seqwater Document Owner as listed in the document footer, via the Engineering Mailbox, for clarification. Where it is proposed to proceed without meeting the requirements of this standard, agreement must be obtained via the Deviation Process, as outlined above.

Seqwater undertakes regular updates of its Engineering Standards. Before utilising this Engineering Standard the complete list of Seqwater Engineering Standards should be reviewed to ensure currency and applicability of standards to be applied to the works. These can be accessed on the Waternet [Seqwater Engineering Standards & Framework](#) page or from your Seqwater project manager, design manager, or engaging officer.

Changes to PFDs/P&IDs shall comply with the protocol outlined in *X-PRO-STD-014 Drawings Management*.

PFDs and P&IDs are information artefacts contributing to the Asset Information Model and must comply with Asset Information Management Framework principles on asset hierarchy, data quality and lifecycle information management.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	6 of 22

3. Definitions

The following definitions (Table 1) apply to this Standard Specification.

Table 1 Definitions

Term	Definitions
Contractor	An entity engaged by Seqwater to undertake work in accordance with an agreed contract and defined scope of work.
Fit for purpose	Suitable for the intended purpose and meets the performance requirements set out in this standard and other project documents.
Manufacturer / Supplier / Vendor / Original Equipment Manufacturer (OEM)	The entity that manufactures or supplies equipment to meet the specifications of the Contractor.
Owner / Principal / Seqwater	The entity that engages the Contractor to undertake the work and takes custody of the outcome. The Owner may delegate responsibilities to other entities to act on its behalf (e.g., a consultant).
REX	Seqwater Electronic Document and Records Management System.
Seqwater Approval / Acceptance	Written sign-off gained via the deviation process, as detailed in <i>X-PRO-STD-008 Asset Standards Management and Application</i> .
Seqwater Engineering Standard	Includes Standard Procedures and Standard Specifications and associated supporting documents such as Standard Drawings, Guidelines, Lists, Datasheets, Manuals, Registers, and Templates.
Shall / must	Indicates a mandatory requirement
Should	Indicates a recommendation

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	7 of 22

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

4. Abbreviations

The following abbreviations (Table 2) apply to this Standard Specification.

Table 2 Abbreviations

Abbreviation	Description
AIMF	Asset Information Management Framework
ALARP	As Low As Reasonably Practicable
ANSI	American National Standards Institute
BPCS	Basic Process Control System
BWL	Bottom Water Level
CCP	Critical Control Point
HAZOP	Control Hazard and Operability
ESD	Emergency Shut Down
H	High Alarm
HACCP	Hazard Analysis and Critical Control Points
HAZOP	Hazard and Operability
HH	High High Alarm
ISA	International Society of Automation
L	Low Alarm
LL	Low Low Alarm
MOL	Minimum Operating Level
mAHD	The abbreviation for elevation in meters with respect to the Australian Height Datum
OT	Operational Technology
PFD	Process Flow Diagram
PID	Proportional, Integral and Derivative control
P&ID	Piping and Instrumentation Diagram
RPEQ	Registered Professional Engineer of Queensland
SIF	Safety Instrument Function
SIL	Safety Integrity Level
SIS	Safety Instrument System
Spec break	Specification break
SPO	Special Purpose Outlet
TWL	Top Water Level

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	8 of 22

This document is the property of Seqwater. It must not be copied or reproduced in any way whatsoever without the authority of Seqwater. This document is uncontrolled when printed. An electronic database manages and stores the controlled version.

5. Roles and Responsibilities

The following roles and responsibilities (Table 3) are applicable in the context of this specification.

Table 3 Roles and Responsibilities

Role	Responsibility
Coordinator, Plans and Drawings	- Manages Seqwater's drawings database as per Seqwater standards <i>X-PRO-STD014 Drawings Management</i>, <i>X-PRO-STD-002 Drawing Number Procedure</i> and <i>X-PRO-STD-007 Drawing & Spatial Data Standards</i>. - Main contact for all drawings database queries. - Checks in / out drawings, issues new drawing numbers, supersedes / obsolete drawings, co-ordinates internal redline mark-up drawing updates, and any other drawings management activities.
Manager, Service Delivery, DTI	Accountable for implementation and management of this specification.
Process Engineers	Responsible for compliance with this specification when creating or editing Process Flow Diagrams or Piping & Instrumentation Diagrams.
Project Manager	Accountable for project compliance with this specification.
Seqwater Drawings Requestor	- Requests existing drawings or new drawing numbers from the Coordinator, Plans and Drawings via the Engineering Mailbox. - Liaises with external drawings users. - Responsible for compliance with this specification for Process Flow Diagrams and Piping and Instrumentation Diagrams. - Returns drawings to the Coordinator, Plans and Drawings via the Engineering Mailbox and meets the requirements of <i>X-PRO-STD-014</i>.
Team Leader, Process & Analysis	Responsible for implementation and management of this specification.
Workers / Employees	Be aware of and comply with this Engineering Standard B-SPE-STD-007 Process Flow Diagram and Piping and Instrumentation Diagram Requirements.

6. Reference Documents

The documents listed in Table 4 and Table 5 below, and the requirements therein, are relevant to this Standard Specification. In their latest editions, these documents form a part of this document. Note that this is not an exhaustive list of documents relevant to the works.

Seqwater undertakes regular updates of its Engineering Standards. Before utilising this document, the complete list of Seqwater Engineering Standards should be reviewed to ensure currency and applicability for the proposed works.

Table 4 Reference Seqwater Documentation

Asset Standard Document Number	Document Title	Waternet/REX Reference
X-FRA-STD-002	Information Requirements for BIM Framework	FRA-00052
X-PRO-STD-001	Asset Standards Document Classification and Naming Structure Procedure	PRO-01873
X-PRO-STD-002	Engineering Drawing Numbers Procedure	PRO-01872
X-PRO-STD-004	Development and Review of Asset Standards Procedure	PRO-01874
X-PRO-STD-006	Equipment Numbering and Naming Convention	PRO-02190
X-PRO-STD-007	Drawing & Spatial Data Standards Procedure	PRO-02187
X-PRO-STD-008	Asset Standards Management and Application Procedure	PRO-02205
X-PRO-STD-009	Engineering Design, Construction, Operation and Maintenance Procedure	PRO-01617
X-PRO-STD-012	Accessing Drawings Stored in REX Procedure	PRO-02191
X-PRO-STD-014	Drawings Management Procedure	PRO-02253
X-TMP-STD-022	Asset Standards Deviation Request Template	TEM-00224
X-TMP-STD-030	Project Exchange Information Requirements (EIR) Template	TEM-00428
X-TMP-STD-031	Project Information Management Responsibility Matrix Template	TEM-00429
X-TMP-STD-032	Master Information Delivery Plan Template	TEM-00430
X-TMP-STD-033	Model Element Authoring and Delivery Scheduling All Assets Template	TEM-00431
X-DWG-STD-00005	Title Block P&ID Drawings	D18/156707
B-PRO-STD-003	Piping and Instrumentation Diagram Drafting Procedure	PRO-02320
B-DWG-STD-00001	P&ID, Legend - Sheet 1 of 5, Piping, Valve & Fitting Symbols	691454
B-DWG-STD-00002	P&ID, Legend - Sheet 2 of 5, Instrument & Control Valve Symbols	691455
B-DWG-STD-00003	P&ID, Typical Details - Sheet 1 of 2, Instrumentation Valve	843200

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	10 of 22

Asset Standard Document Number	Document Title	Waternet/REX Reference
B-DWG-STD-00004	P&ID Typical Details - Sheet 2 of 2, Motor Control	843198
B-DWG-STD-00005	P&ID, Legend - Sheet 3 of 5, Material Codes	D18/165556
B-DWG-STD-00006	P&ID, Legend - Sheet 4 of 5, Major Equipment Symbols	D18/165558
B-DWG-STD-00007	P&ID, Legend - Sheet 5 of 5, Minor Equipment & Miscellaneous Symbols	D18/165560
I-TMP-STD008	Master Alarms Template	TEM-00254
I-TMP-STD-013	Cause and Effect Matrix (C&E) Template	TEM-00327
I-TMP-STD-001	Functional Description Part A Template	TEM-00221
I-TMP-STD-005	Functional Description Part B Template	TEM-00222
B-SPE-STD-005	Functional Description Documentation	SPE-00349
I-SPE-STD-005	High Priority Alarms & Interlocks Management	SPE-00356
I-SPE-STD-006	Alarm and Event Management	SPE-00357

Table 5 Reference External Standards, Specifications and Codes

Standard/Specification	Document Title
AS 1100	Technical Drawing
ANSI/ISA-5.1-2024	Instrumentation and Control – Symbols and Identification

7. Drawings Management

Process Flow Diagrams and Piping & Instrumentation Diagrams are covered by X-PRO-STD-014 Drawings Management Procedure ([PRO-02253](#)) and must follow all prescribed procedures therein.

All official correspondence in relation to Drawings Management shall be directed via the Engineering Mailbox (engineering@seqwater.com.au). This includes new drawing number requests and access to existing drawings for editing.

Numbering of Process Flow Diagrams and Piping & Instrumentation Diagrams are covered by X-PRO-STD-002 Engineering Drawing Numbers Procedure ([PRO-01872](#)). The discipline code to be used is "B". Drawing number requests should be made with a reasonable attempt to ensure numbering occurs sequentially by process flow and process groups.

8. Process Flow Diagram

8.1. Purpose

A Process Flow Diagram (PFD) shows the relationships between the major process units in a system or pipeleg. A person unfamiliar with a process should be capable of understanding the process configuration, main safety systems and main controls via a PFD. The following key attributes shall be shown on a PFD:

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	11 of 22

- Plant design basis: Tabulated material balance with process operating and design envelopes for the process units.
- Scope of process: Identify and outline the scope of the process, boundaries, and major interfaces.
- Equipment configuration: Representation of major equipment and process (with equipment description).
- Required utilities: Show the utilities (e.g., chemicals) which are used in the process.
- Controls: Main control loops; illustrating the control strategy.

8.2. Content

The minimum requirements for a PFD shall include:

- All process units which make up the process.
- Main process pipelines.
- Critical interlocks that will result in a shutdown of the plant, pipeleg or process unit.
- Process control loops which govern the process monitoring shall be shown. For example, a pump station that is controlled by a flowmeter.
- Equipment redundancy.
- Filters shall be labelled to describe the media configuration.
- Inlet and outlet levels for gravity lines, where necessary to understand the process.
- Key safety systems such as emergency shutdown valves.
- Main control valves.
- Major bypass lines.
- Water quality instrumentation and flow meters.
- All equipment shown on the PFD shall be shown with an equipment number. Equipment numbering shall be in accordance with *X-PRO-STD-006 Equipment Numbering and Naming Convention*.
- Process trains shall be shown

A PFD shall show simplified material balances in a tabular format for all process lines and all design cases. Detailed material balances should be included as a separate document.

The simplified table should include the following:

- Flow rates under operating conditions to the extent covering the operating and design envelopes (i.e., design flow, Peak Rated Capacity, and other design points, e.g., 50%, 80% and 95%ile and 99%ile raw water conditions).
- Chemical dose rates under average, Peak Rated Capacity, and other design points, e.g., 50%, 80% and 95%ile and 99%ile raw water conditions.
- Design, Peak Rated Capacity, and other design points, e.g., 95%ile and 99%ile, for raw water solids loading rates.
- Each stream/line shall have a stream number.

Where applicable, PFD's will also show:

- Reservoir operating conditions to the extent covering the operating and design envelopes
 - Top Water Level (TWL) in mAHD
 - Bottom Water Level (BWL) in mAHD
 - Minimum Operating Level (MOL) in mAHD

PFD's typically do not show the following:

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	12 of 22

- Pipe class
- Pipeline numbers
- Minor bypass lines
- Isolation and shutoff valves that are not part of safety systems
- Maintenance vents and drains

8.3. File Format, Layout and Legibility

The Seqwater standard title block *X-DWG-STD-00005 Title Block P&ID Drawings* shall be used for PFDs.

AutoCAD shall be used to produce PFDs. Examples of the expected format and quality to be used are available on request.

PFDs shall be provided in both PDF (portable document format) and CAD format. Refer to *X-PRO-STD-007 Drawing & Spatial Data Standards* for details on this requirement.

Block diagrams are not acceptable for PFDs, unless agreed to prior by Seqwater.

Generally, a PFD per facility will be shown on one page; however, for larger facilities or more complex processes multiple pages shall be used. For multiple page PFD's, all page connectors shall contain the drawing number, a descriptor of the medium on the top and a destination (or origins) descriptor on the bottom.

PFDs shall generally be read from the top or left-hand side of the drawing.

Main flow on each PFD shall be from left to right. The main flow shall not "double back" (i.e., start on the top left-hand side and end on the bottom left-hand side or vice versa).

Main process lines shall be shown thicker than the secondary and utility process lines.

Process units shall be depicted using unit symbols as per B-DWG-STD-00001 - 00007 where possible. Any alternative unit symbols must not use excessive detail; they should aim only to convey the unit's identity and its core functions. If a unit symbol from B-DWG-STD-00001-00007 is used and amended with further detail (e.g. for compartments, weirs, baffles, trays, or similar fixtures), this detail should be relevant to core process functions only and should be similarly minimalistic.

The designer's company logo can be shown in the title block on the left-hand side. If, at Seqwater's sole discretion, the PFD is unclear; the PFD shall be deemed as non-compliant with this Standard Specification.

8.4. Updates to PFD's

When updating a PFD from an earlier version, all changes made shall be clouded, numbered and a note provided on the revision section of the border. PFDs shall be maintained current to depict the actual installation including changes and updates during operations. Updates shall comply with the requirements as outlined in *X-PRO-STD-00014 Drawings Management Procedure* and *X-PRO-STD-009 Engineering Review and Approval*.

9. Piping and Instrumentation Diagrams

9.1. General

A P&ID (piping & instrumentation diagram) is a diagrammatic representation of the process and its control. P&IDs shall show the complete process, including all the process equipment (including redundant equipment yet to be decommissioned and removed), installed spares, piping and valves, pipe fittings, insulation, specification breaks,

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	13 of 22

instrumentation and associated display and alarms, control loops and other engineering details that are required to design, construct, and operate the process.

P&IDs are a key design deliverable and shall be maintained current to depict the actual installation including changes and updates during operations as per the requirements noted in *X-PRO-STD-014 Drawings Management Procedure* and *X-PRO-STD009 Engineering Design, Construction, Operation and Maintenance*.

The P&IDs function is to show that the design is consistent with current legislation, regulations, codes, standards, guidelines, and industry best practice. They also show that the design can be operated safely under defined process conditions. The P&IDs function as the main documents for safety risk assessments, such as HAZOP/HAZOP, and are integral to show the ALARP (As Low As Reasonably Practicable) design requirement is satisfied. The responsibility and accountability for approval and maintaining the P&IDs are outlined in *X-PRO-STD014 Drawings Management Procedure*.

It is noted that for existing assets, where P&IDs are being created or updated to reflect what is existing or “As Found”, the equipment is not necessarily consistent with current legislation, regulations, codes, standards, guidelines and industry best practice. For new drawings of existing assets and guidance for ‘As found’ see *X-PRO-STD-014*. As per *X-PRO-STD-009 Engineering Design, Construction, Operation and Maintenance Procedure* ([PRO-01617](#)), Seqwater requires that all engineering documents, including P&IDs, produced as deliverables in undertaking Professional Engineering Services for Seqwater must be certified by the responsible Competent Engineer/s by including their signature, name, RPEQ Registration Number and discipline of registration to demonstrate compliance with the *Professional Engineers Act 2002 (Qld)* and Good Engineering Practice.

9.2. File Format, Revisions, Title Block and Legibility

The Seqwater standard title block *X-DWG-STD-00005 Title Block P&ID Drawings* shall be used for P&ID’s.

All files shall be supplied as AutoCAD files and be consistent with the requirements outlined in *B-PRO-STD-003 Piping and Instrumentation Diagram Drafting Procedure* and *X-PRO-STD-007 Drawing & Spatial Data Standards*.

New equipment or changes shall be shown by ‘revision cloud’ around the area with a numbered revision triangle corresponding to the revision of the drawing. No equipment on the P&ID shall be greyed out, see section 9.8 for annotations.

The title block, shall function as a register of revisions and notes to describe the update undertaken, complying with *X-PRO-STD-007 Drawing & Spatial Data Standards* and revision number as per *X-PRO-STD-014 Drawings Management Procedure* ([PRO-02253](#)).

The designer’s company logo can be shown in the title block on the left-hand side.

Changes made in a new revision are to be clouded with revision number shown next the cloud in a triangle, refer to *X-PRO-STD014 Drawings Management Procedure* ([PRO-02253](#)) for more details.

If, at Seqwater’s sole discretion, the P&ID is considered to be unclear; the P&ID shall be deemed as non-compliant with this Standard Specification.

9.3. Drawing Arrangement

To provide for future modifications and legible drawings, there shall be no more than four major equipment representations shown on a single drawing.

P&ID representations shall be in sideview with equipment, piping, valves, and instruments arranged, in relative spatial orientation, similar to the physical installation.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	14 of 22

Exceptions may be permitted to highlight the functionality of a process unit, such as a ring main. In such cases, approval must be obtained from the Seqwater.

Equipment numbering should follow the process flow and proceed from left to right and from top to bottom on vertical equipment. It is preferred that related instruments or instruments within a control loop have the same unique number; For example: TEB-I-1FE001, TEB-I-1FIT001 and TEB-I-1FCV001. Refer to X-PRO-STD-006 Equipment Numbering and Naming Convention Procedure ([PRO-02190](#)) for details on equipment numbers.

Equipment number and associated data shall be shown on the top of the P&ID (as per Section 9.5).

Utilities systems (e.g., cooling water, service air, service water, etc.) should be shown on separate P&ID(s). Combining several systems on one P&ID is subject to the approval of Seqwater.

9.4. Symbols, Legend & Typical Sheets

All P&ID drawings shall comply with the requirements outlined in the P&ID Symbol and Legend sheets listed below and the requirements in *B-PRO-STD-003 Piping and Instrumentation Diagram Drafting Procedure*.

- B-DWG-STD-00001 P&ID, Legend - Sheet 1 of 5, Piping, Valve & Fitting Symbols
- B-DWG-STD-00002 P&ID, Legend - Sheet 2 of 5, Instrument & Control Valve Symbols
- B-DWG-STD-00003 P&ID, Typical Details - Sheet 1 of 2, Instrumentation Valve
- B-DWG-STD-00004, P&ID Typical Details - Sheet 2 of 2, Motor Control
- B-DWG-STD-00005 P&ID, Legend - Sheet 3 of 5, Material Codes
- B-DWG-STD-00006 P&ID, Legend - Sheet 4 of 5, Major Equipment Symbols
- B-DWG-STD-00007 P&ID, Legend - Sheet 5 of 5, Minor Equipment & Miscellaneous Symbols

ANSI/ISA-5.1-2024 serves as the authoritative standard for instrumentation and control symbols, incorporating specific modifications to accommodate Seqwater's requirements.

Designers of control valve and motor control circuits should make a reasonable attempt to match designs to typical sheets shown in B-DWG-STD-00003 and B-DWG-STD-00004. Where designs match, the P&ID shall use the designated P&ID representation shown on the typical sheet, inclusive of "DETAIL V/MX". Use of symbols not included in the legend sheets listed above must be agreed to by Seqwater.

9.5. Equipment, Valves, Instrumentation and Piping

All equipment, valving, instrumentation, and piping shall be labelled consistent with the requirements in *X-PRO-STD-006 Equipment Numbering and Naming Convention*.

9.5.1. Equipment

All equipment shall be consistent with the designations provided in *B-DWG-STD-00001 to B-DWG-STD-00007*. Equipment shall show motor, vents, manholes, nozzles/ connection points, and any other representations that aid in understanding the process function (e.g., overflow paths or sloped floors for solids collection). No serial No. / maintenance data.

Major equipment, as defined in *B-DWG-STD-00006*, shall have data shown across the top of the P&ID above the equipment and shall include:

- Equipment number & description (consistent with *X-PRO-STD-006 Equipment Numbering and Naming Convention*)
 - Legacy numbers can be shown beneath equipment numbers if applicable

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	15 of 22

- Size and capacity
- Design pressure and temperatures
- Materials of construction
- Power requirements

The below are specific minimum technical details that shall be shown for the following equipment:

Large Pumps

- Rated kW
- Design suction pressure and temperature
- Design discharge pressure and temperature
- Design flow and pressure

Small Pumps

- Rated kW
- Design flow and pressure

Reservoirs / Tanks

- Volume
- Design retention time (if applicable)
- Top Water Level (TWL) elevation in meters with respect to the Australian Height Datum (mAHD)
- Bottom Water Level (BWL) in mAHD
- Minimum Operating Level (MOL) in mAHD
- Materials of construction

Liquid Chemical Storage Tanks

- Volume
- Materials of Construction

Granular Media Filters

- Surface Area
- Filtration Rate
- Media depth
- Media type

Centrifuges

- Rated rpm
- Unit capacity (kgDS/h)

Sedimentation Basin

- Capacity
- Dimensions
- Detention Time

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	16 of 22

Clarifier

- Capacity
- Dimensions
- Construction

Other Motors (e.g., Mixers, rakes)

- Rated kW

9.5.2. Motors

Other than for simple motor control, motor controls shall be shown on dedicated detail P&IDs. Multiple motor control circuits may be shown on a single P&ID for motors. Seqwater aims to standardise motor controls and as such, designers will make a reasonable attempt to align motor control circuits with the typical representation shown on *B-DWG-STD-00004*. Variation from standard shall require approval by Seqwater.

When used for equipment isolation, local switches such as Special Purpose Outlet (SPO) are to be shown on P&IDs.

9.5.3. Valves & Actuators

All valves shall be shown, except those valves that are inherent to an abbreviated representation (e.g., a solenoid valve for air actuation).

Valves shall be represented according to *B-DWG-STD-00001* and shall be complete with representations of the pipe fittings connection (e.g., flange, screw, etc.), actuation (where applicable), associated equipment numbering and normally open / closed / locking / fail mode / manual interlock modes (where applicable).

Details of valve actuation are to be shown on dedicated details P&IDs, not on the main process P&ID. Refer to *B-DWG-STD-00003*, which gives guidance on what to include in the main process P&ID and standard detailed drawings for four typical valve/actuator types. Seqwater aims to standardise valve controls and as such, valve control should comply with one of these typical representations shown on *B-DWG-STD-00003*. Variation from standard shall require approval by Seqwater.

For actuated valves, the air diaphragm / piston and hydraulic actuation symbols shall be considered to inherently represent the required service air and fluid, respectively, and a dedicated utilities connection is not required. The exception to this is where it is necessary to show the utilities connection for the purposes of valve operation reliability, for example, emergency shutdown (ESD) valves.

An ESD valve shall be complete with solenoid valve and other instrumentation that constitutes the safety system of which the ESD is part of.

Detailed utility P&IDs shall show the connections to the actuated valves diagrammatically, with actuated valves shown on the main P&IDs only.

Valve position codes shall comply with the position codes as per *B-DWG-STD-00002*. Control valves shall have equipment numbers using control valve codes on *B-DWG-STD-00002* and are not numbered based on the valve type, for example TEB-V-1FCV001 instead of TEB-V-1BF001; however, symbols for control valves shall still comply with *B-DWG-STD-00001*.

9.5.4. Instrumentation

Analysis instruments shall be represented as an element without representation of the internal details. The internal details shall be from the supplier and their documentation shall be accessed separately for details.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	17 of 22

All instrumentation shall be shown, including the sensor / element / probe / transducer and associated transmitter, consistent with the representation designations provided in *B-DWG-STD-00002*. Legacy numbers can be shown in brackets near the instrument at the appropriate component.

All instrumentation shall clearly show the spec break from process piping to instrumentation piping (see Section 9.8), typically on the discharge connection of the isolation valve(s). Isolation requirements between the instrument piping and process piping shall be confirmed with Seqwater.

The analyser waste stream is to be shown on P&ID's, whether it discharges back into the main process stream, to drain or the environment. If deemed to be required, a note can be added to P&ID to identify if reagents are added to analyser sample stream.

Instrument function lookup table and selected standardised abbreviated instrument function codes as per *B-DWG-STD-00002* shall be used. Instrument codes, symbols, and general depictions are based on those outlined in ANSI/ISA-5.1-2024, Instrumentation and Control – Symbols and Identification, with some modification to suit established Seqwater conventions.

9.5.5. Piping

All process piping shall be shown, complete with size, line number, piping specification identification, double containment, and insulation (where required).

Pipe sizes shall be shown in Diameter Nominal (DN).

All fittings / piping specialty (SP) items shall be shown including, but not limited to, orifices, pipe connections (e.g., process relevant flanges, screw, etc.), thermowells, sample connections, vents, drains, spectacle blinds, spade blinds, removable spools, pipe reducers / expansion, static mixers, injection quills, strainers, expansion joint / bellows, and the like.

Piping specification changes (spec breaks) shall be clearly labelled whenever the pipe material changes on the line, the line changes from above ground to underground or vice versa, the line changes from process piping to instrument piping or the line crosses a sub-area boundary.

The extent of piping shall cover all process, utility and disposal, start-up and shut-down lines, flush lines, bypasses, drain and pump-out lines, sample connections and sample lines, drain and vent points etc.

The conventions adopted at Seqwater include:

1. There is often substantial tubing used which is typically black nylon small bore tubes. These are not considered of value to denote as piping and hence are typically given an instrument like representation (e.g., pneumatic, or capillary tubing see *B-DWG-STD-00001*).
2. Connections other than flanges (e.g., screw, glued and others) are used extensively on small bore plastic pipe. For simplicity, these are commonly not shown but are noted.
3. Pipe size changes are very common on small bore plastic pipe. These must all be shown as a spec break or reducing tee, as applicable.

9.5.6. Process Safety Components & Non-operational Equipment

All process safety components shall be shown such as relief valves, rupture discs, fail actions on actuated valves, valve interlocking designations, and the like. Set pressure and size for pressure relief (safety) valves shall be shown close to the valves.

Vents and drains which are not required for process or operational reasons, such as hydrotesting connections that are blanked without a valve, are not shown on the P&ID.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	18 of 22

9.6. Major Transmission Pipelines

Major transmission pipelines shall require P&ID representation and shall otherwise comply with the requirements noted in this Standard Specification, with the following exception:

Where multiple scour valves, air release / intake valves, flanges, and the like are along the length of the pipeline, these shall be represented as a single unit within a dashed box, complete with a note. In the note the number and location of the item shall be listed in a table on the drawing at a convenient location.

9.7. Process Control, Alarms & Safety Instrumented Functions

For all instruments, the function shall be shown as at the relevant location, whether it is local, on a local panel, or on a control room panel or a combination of these.

Instrument alarms shall be represented by an alarm symbol connected to the relevant instrument as per B-DWG-STD-00002. All configured plant alarms for analogue instruments are to be shown. In the case of water quality instrument's fault alarms can be shown. All HACCP alarms must be shown on P&ID's. Digital instrument alarms are to be shown such as alarms for flow, pressure, or level switches. An alarms list is intended to capture all other alarms. Refer to I-SPE-STD005 High Priority Alarms & Interlocks Management ([SPE-00356](#)) and I-SPE-STD-006 Monitoring and Control System Alarm and Event Management ([SPE-00357](#)).

Seqwater convention for showing alarms on P&IDs is as a Primary Choice/Primary Location Normally Accessible representation as shown in *B-DWG-STD-00002* in the instruments lookup table and example shown in HACCP and Plant Alarming section. A single symbol may be shown per instrument for plant alarms and HACCP alarms, if applicable. For water quality instruments AAU code standing for analyser alarm multiple can be used with the parameter measured noted beside the analyser e.g., Turbidity, Temperature etc. Alphabetical letter(s) to the right of the alarm symbol depicting the configured plant alarms as per B-DWG-STD-00002 e.g., HH, LL. HACCP alarms, if applicable, are to be shown on the left of the alarm symbol, with acronyms identifying configured HACCP alarms, refer to B-DWG-STD-00002. Switches can have a single symbol with the alarm identified using an appropriate letter code as per *B-DWG-STD-00002* e.g., LAH, FAL. Some examples are shown below in Figure 1, symbols and codes used are instrument specific.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	19 of 22

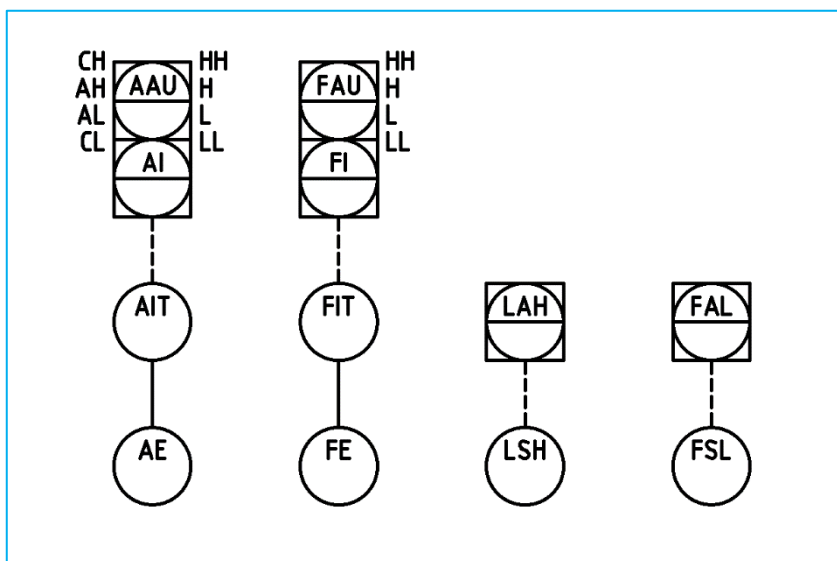


Figure 1 – Example P&ID Representation of Alarming: Analyser, Flowmeter, Level Switch and Flow Switch (Note: HACCP alarm acronyms shown on the left of the analyser alarm symbol and plant alarms shown on the right)

The basic process control system (BPCS) shall be shown on P&IDs. The guidelines and requirements for representation of the BPCS as provided in *ANSI/ISA-5.1-2024 Instrumentation and Control – Symbols and Identification* shall be complied with, with the exception to 'modified ISA' notes on *B-DWG-STD-00002, 00003 & 00004*. Both basic automatic control loops and manual controls shall be shown on the P&IDs. Control loops shall be shown complete with measured and manipulated variables and controller. Electrical and communications links shall be shown. Interlocks are shown only symbolically on P&IDs. Critical interlocks that will result in a shutdown of the process unit or plant shall be shown. A Cause and Effect Matrix is intended to capture hardware safety trips and trip interlocks. While hardware interlocks, process permissives and start permissives are detailed in the Functional Descriptions Part A and Part B, refer to B-SPE-STD-005 Functional Description Documentation ([SPE-00349](#)).

The complete functional description is not shown on the P&IDs. Auxiliary documents (e.g., functional descriptions and cause and effect matrix) shall be used to describe the complete functions. For model based advanced control and multi-variable controls whose function cannot be clearly and easily understood by P&ID representation, the input instruments and controls shall be represented to show the basic function and refer to model and advanced functional descriptions (e.g., a filter control).

Guidance of what control to show on P&IDs is:

- Show process group and/or process unit control where applicable, typically simplified as a single multi variable controller "UC" block. This single symbol represents most process unit/group control such as supervisory control and duty rotation.
- Show basic process control loops as a connection between instruments and devices, using off page connectors where required.
- Show any PID controllers (For example FIC for a PID controlling flow or PIC for a PID controlling pressure) or any basic controllers such as timer controllers. Letter codes for functions as per *B-DWG-STD-00002*.
- Show critical interlocks that will result in a shutdown of the process unit or plant.

The controller shown on the P&ID would typically be described in the functional description. The controller functional descriptions may include details on set point control, start-up permissives, some software interlocks

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	20 of 22

and the like, typically for a group process level control. Equipment level control may be shown diagrammatically and the typicals *B-DWG-STD-00003* and *B-DWG-STD-00004* provide an indication of the extent shown. Equipment level trips, permissives, interlocks and the like would typically be described in the functional description.

Safety Instrumented Functions (SIF) shall be labelled as “SILn”, where n is the Safety Integrity Level (SIL) rating required of the function. Signals utilising an independent logic solver (whether a Safety Instrumented System (SIS) or not) shall be shown as alternative control/SIS representation as per *B-DWG-STD-00002*. Voting systems on multiple sensors for control/analogue values (median select, high select, low select, average) shall be shown using the representation from *B-DWG-STD-00002*, and any voting systems for discrete values and actions labelled as Number out of Number – e.g., 2oo3.

9.8. Annotations & Off Page Connections

The P&IDs shall show engineering requirements necessary for the design, including but not limited to:

- Slope grade representation with triangle.
- Flow direction arrows.
- Minimum straight pipe lengths / minimum or maximum distances.
- Relative equipment elevations including relative level value where important to understand the design.
- Under grade or within accessible pits.
- Expansion loops, pipe lagging or insulation or double containment.
- Bund covering if important for safety understanding (e.g., acid dosing system spills with rainwater mixing).
- Spec breaks including pipe material and / or pressure class changes, above grade / under grade, instrumentation piping / process piping, refer to *B-DWG-STD-00001*.
- Sub area breaks to show when a process changes from one sub-area to another.
- Revision cloud and revision triangle when a change is made on the drawings.
- Tie-in points when connecting new pipework / equipment with existing, refer to *B-DWG-STD-00001*.
- Battery limits to delineate process boundaries, refer to *B-DWG-STD-00001*.
- Cloud with hash lines around the equipment which has been removed, decommissioned, or demolished to indicate no longer in use.

Main process lines shall be shown thicker than secondary process and service lines. Lines (process or control) continuing within a process should normally end at the right side of a P&ID sheet (left side can be used by exception). The number of line crossings should be minimised where possible.

When lines enter or exit a sheet, the connecting P&ID number shall be shown in an off-sheet connector chevron (one-way or bi-directional) and a short description of the line contents (on top) and source / destination (at bottom) shall be shown.

Where an integral part of a process cannot be shown easily on the P&ID, this shall be annotated to reference a separate detailed P&ID with necessary details shown.

Equipment shall be shown in representative orientation.

9.9. Vendor Equipment

Equipment supplied by a vendor shall be drawn in a demarcated representation on the P&ID during the design development. The vendor equipment shall be represented within the demarcated boundary to reflect the most likely key elements of the procured equipment.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	21 of 22

Upon procurement of the equipment, the vendor equipment demarcation shall be removed, and the equipment representation shall fully reflect the requirements noted in this Standard. This may require the re-drafting of the vendor equipment P&ID to meet this Standard's requirements.

Any equipment that remains fully or partially "vendor-locked" (i.e. if any maintenance tasks require support from the vendor or other specialty contractors) after commissioning shall be noted as such on the P&ID.

9.10. Notes & Holds

Numbered notes and holds pertaining to the P&ID can be included, in a suitable location, preferably in a bottom corner.

Notes shall be added to convey information that cannot be captured in a symbol or code abbreviation and that is required to understand the process. Notes shall cover non-standard instructions in the process of design development. Notes shall be numbered with the number next to the item it pertains to and the number and note details listed, preferably in a bottom corner of the drawing.

Holds shall be added where information is unavailable at the time of the revision and shall be numbered with the number placed next to the item it pertains to and the number and hold details listed, preferably in a bottom corner of the drawing. Holds shall be kept to a minimum and closed out promptly as information is acquired.

If a note or Hold is deleted, the number shall not be used for another note but shown as "deleted".

9.11. Utilities

All utility lines shall terminate near to the equipment or actuator that utilises it with an appropriate code abbreviation, as per *B-DWG-STD-00002*.

10. Changes from previous version

This Standard Specification will be regularly reviewed and updated, including the consideration of requested alterations, in accordance with Seqwater Procedure X-PRO-STD-004 Development and Review of Asset Standards.

Section Number	Change
1. Purpose & 2. Scope	Update wording to X-TMP-STD-002 Rev 17 Engineering Procedure / Standard Specification Template (TEM-00239)
6. Reference documents	Update table to include BIM standards.
General	Minor updates to provide clarity.

11. Verification

Compliance with the document may be verified by internal audit.

12. Further Information

For further information please contact the owner of this document.

Version No.	Document No.	Document Owner:	Approval Date:	Document Approver:	Page:
4	SPE-00351	Team Leader Process & Analysis - P7404	16/03/2026	Manager Service Delivery	22 of 22