เอกสารแนบ 1

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

TABLE OF CONTENTS

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

1. PURPOSE

The objective of this protocol is to provide documented evidence that:

- The system's installations conform to the user's requirements as laid down in the design specification.
- The system's installations are executed correctly as per design specifications or manufacturer's. recommendations and are suitable for their intended use.
- The documentation, as specified in this protocol is available, adequate and of appropriate quality.

2. DEFINITION / ABBREVIATION

IQ	Installation Qualification
OQ	Operational Qualification
P&ID	Piping & Instrumentation Diagram
PW	Purified Water
UV	Ultraviolet light
FE	Facility and Engineering Department
VA	Validation Department
QA	Quality Assurance Department

3. REFERENCE

3.1 *Good Manufacturing Practices for Modern Pharmaceutical Products*, Laws of Thai Ministry of Public Health, Food and Drug Administration (FDA), B.E. 2554

3.2 *WHO Good Manufacturing Practices: Water for Pharmaceutical Use, WHO Technical Report Series, No. 970,* 2012, Annex 2

3.3 *ISPE Baseline Guide: Volume 5 - Commissioning and Qualification,* International Society for Pharmaceutical Engineering, 2001.

3.4 *ISPE Baseline® Guide: Volume 4 – Water and Steam Systems,* International Society for Pharmaceutical Engineering, 2001.

3.5 *Pharmaceutical Inspection Cooperation Scheme (PIC/S), Inspection of Utilities, PI 009-3, 25 September 2007*

3.6 *Construction Completion Pre-commissioning & Commissioning Dossier: Purified Water System, MWZ/526143/ M-009, Volume 1 of 1, April 2009*

3.7 *Operation & Maintenance Manual: Purified Water System, 1/2 COPY No. 2, MWZ/526143/O&M / M-009, Volume 1-2, 405p, June 2009*

3.8 *Operation & Maintenance Manual: Purified Water System, 2/2 COPY No. 2, MWZ/526143/O&M / M-009, Volume 1-2, 483p, June 2009*

4. SYSTEM OVERVIEW / SPECIFICATION

4.1 General

The Purified Water System Unit 1, (PWS-01) comprises of Water Pre-treatment, RO/EDI skid, 2000L Purified Water Tank, PW distribution loop and related instruments, and is located in PW room. The PWS-01 generated will be distributed to 5 points of use in General Bioprocess 1 (Unit 1). Moreover the PW from this unit is used as feed water to produce Pure Steam (PS) and Water for Injection (WFI) in unit WFIS-01. The loop velocity is not lower than 1m/s to prevent biofilm generation. The Purified Water System unit 1is used in production process that is product contact system which is considered as Direct Impact system according to ISPE baseline pharmaceutical engineering guide, volume 5 commissioning and qualification. Only component that has impact to quality of PW is considered as critical component. The process block diagram that shows production process of PW is illustrated in Figure 1.

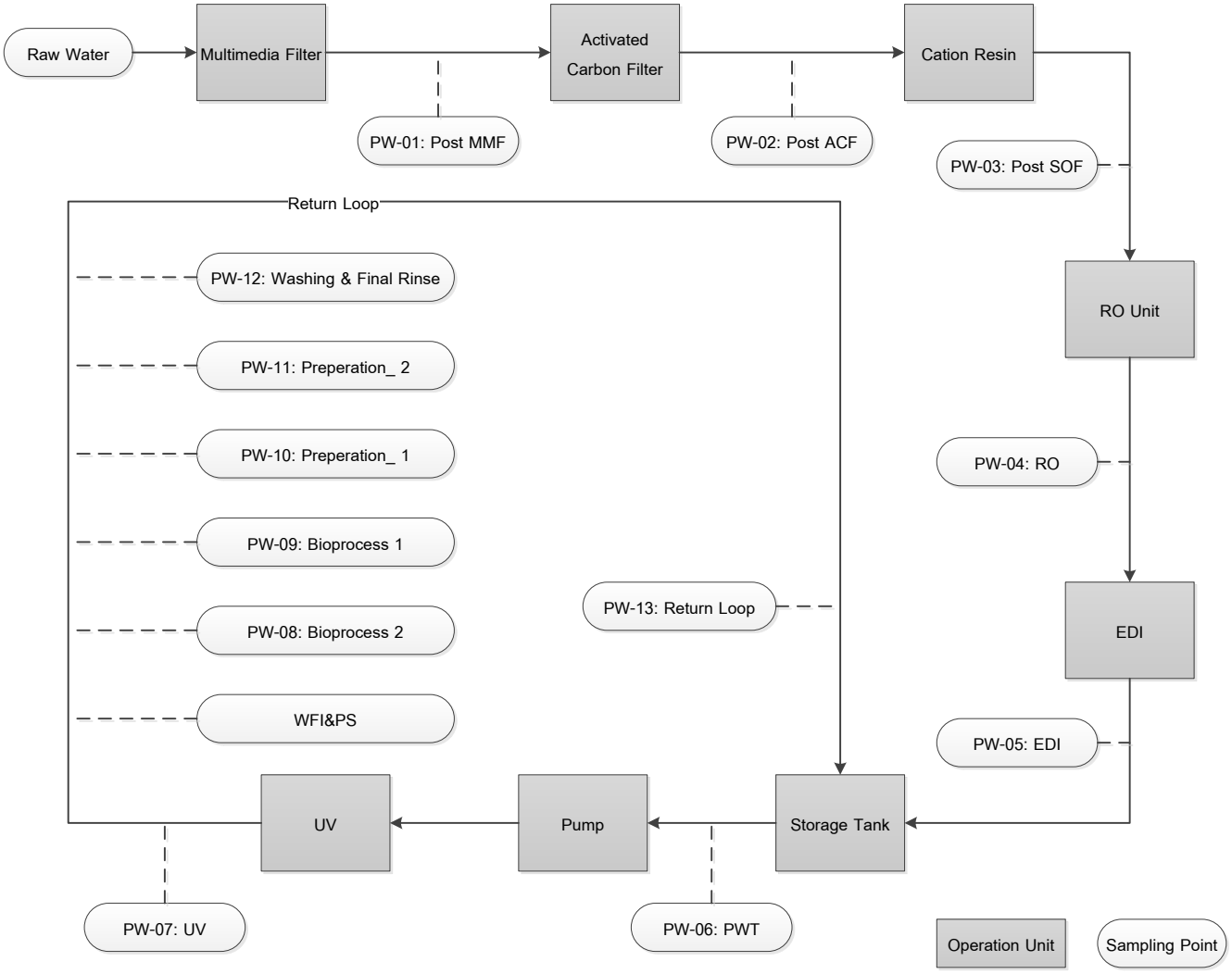


Figure 1 Production Process of Purified Water System Unit 1 (PWS-01)

The system is covered in the following Piping & Instrumentation Diagram (P&ID):

UP00003	Purified Water System Schematic
UP00004	Purified Water Distribution Schematic

4.2 Critical component

Component Name	Component Code	Function
Activated Carbon Filter	ACF-01	Remove color, odor, chlorine and reduce organic matter
RO unit	RO-01	Reduce inorganic contaminants, organic contaminants, colloids, microorganisms, endotoxin
EDI unit	EDI-01	Reduce ionic matters
PW Storage Tank	PWT-01	Storage PW and maintain quality of PW
Air vent filter	N/A	Filter air inlet and outlet of PW storage tank
Spray ball	N/A	Rinse and wet interior surface of PW storage tank
PW Pump	PWP-01	Deliver PW with specified flowrate
Piping System	N/A	Deliver PW to point of use
UV	UV-02	Control bioburden and oxidize ozone in sanitization mode of distribution loop
Ozone generator	OZ-01	Sanitize distribution loop

4.3 Critical instrument

Component Name	Component Code	Function
Level transmitter	LE-2401	Measure level of PW in storage tank to control PW generator
Conductivity sensor	CE-2401	Measure conductivity of generated PW and trigger drain function when conductivity of generated PW is higher than set point
Conductivity sensor	CE-2402	Measure conductivity of distribution loop at return loop
Ozone sensor	OZ-2401	Measure ozone concentration in sanitization mode of distribution loop
Flow sensor	FE-2401	Measure and control PW flowrate in distribution loop

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

The qualification tests are listed as following:

Test No.	Test Name
IQ-01	Documentation Verification
IQ-02	P&ID Verification
IQ-03	Component Verification
IQ-04	Material Verification
IQ-05	Calibration Verification
IQ-06	Verification of Weld Quality
IQ-07	Verification of Dead Legs
IQ-08	Verification of Draining Ability
IQ-09	Verification of Hydrostatic Test
IQ-10	Verification of Cleaning and Passivation
IQ-11	Verification of Utility Connection

PROTOCOL AND REPORT

5. QUALIFICATION TEST

Test Name:	IQ-01: Documentation Verification

Objective

To verify the availability and the completion of the documentation.

Procedure

Verify that documents listed in the test result table are available and complete.

Required Document

Document list

Required Material/Measurement Instrument

N/A

Acceptance Criteria

Each document is provided, all required documents are available and complete.

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Result

Document Name	Document No. and Revision No.	Available and complete (Yes/No)
P&ID		☐ Yes ☐ No, Deviation No._____
Component lists		☐ Yes ☐ No, Deviation No._____
Commissioning Document		☐ Yes ☐ No, Deviation No._____
Design Review Document		☐ Yes ☐ No, Deviation No._____
Operation & Maintenance Manuals		☐ Yes ☐ No, Deviation No._____
Equipment Specification and Certificates		☐ Yes ☐ No, Deviation No._____
Calibration Certificates		☐ Yes ☐ No, Deviation No._____
Material Certificates		☐ Yes ☐ No, Deviation No._____
Welders Certificates		☐ Yes ☐ No, Deviation No._____
Welding Isometric Drawing		☐ Yes ☐ No, Deviation No._____
Weld log		☐ Yes ☐ No, Deviation No._____
Hydrostatic Test Report		☐ Yes ☐ No, Deviation No._____
Passivation Report		☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-02: P&ID Verification

Objective

1. Verify that the installation of PWS-01 conforms to the final P&ID.
2. Verify accessibility to sampling, cleaning and maintenance.
3. Verify that vent filter is available to perform integrity test in place.

Procedure

1. Use P&ID as test record to compare with the system. Use yellow highlight to underline each equipment, device, component, line, dimension, tag (equipment identification label) and instrument in accordance with the relevant drawing. If any non-conformance is found, use a blue ballpoint pen to update the P&ID in order to accurately represent the final installation of the equipment.
2. Review location of sampling valve to access to collect sample.
3. Review location of equipment, device, component, and instrument that are accessible to clean and maintenance.
4. Review installation of vent filter that is available to perform integrity test in place.
5. Sign and date at the bottom of the P&ID.
6. Attach the checked test record to the test report.
7. Attach the updated P&ID to the test report if applicable.

Required Document

1. P&ID of purified water system schematic (PWS-01)
2. P&ID of purified water distribution schematic (PWS-01)

Required Measurement Instrument

N/A

Acceptance Criteria

1. The P&ID is in accordance to the as-built system;
2. All equipment, devices, instrument and components are correctly identified and labeled;
3. The sampling valve locations are able to collect sample;
4. All equipment, devices, instrument and components are able to access to clean and maintenance.
5. The vent filter is available to perform integrity test in place.
6. The checked reference document has been attached to the test report.

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Result

Test topic	Test result pass acceptance criteria (Yes/No)
The P&ID is in accordance to the as-built system;	☐ Yes ☐ No, Deviation No._____
All equipment, devices, instrument and components are correctly identified and labeled;	☐ Yes ☐ No, Deviation No._____
The sampling valve locations are able to collect sample;	☐ Yes ☐ No, Deviation No._____
All equipment, devices, instrument and components are able to access to clean and maintenance.	☐ Yes ☐ No, Deviation No._____

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-03: Component Verification

Objective

1. Verify that the installed valves, instruments and other components are in accordance with the description in the component list.
2. Verify that all installed valves, instruments and other components are sanitary type (able to clean and sanitize).

Procedure

1. Use the component list as the test file; compare the installed components with the component list in respect of equipment model, supplier, technical data, etc. If the actual component is in compliance with the description, use yellow highlight to underline at the component name in the component list; otherwise use blue pen to correct information and raise a deviation.
2. Sign and date at the bottom of each page of the component list.
3. Attach the checked component list to the test report.
4. Attach the updated component list to the test report if applicable.

Required Document

1. Component List

Required Measurement Instrument

N/A

Acceptance Criteria

1. The installed components are in accordance with the description in the equipment list. The checked reference document has been attached to the test report.

Test Result

Acceptance Criteria	Test result pass acceptance criteria (Yes/No)
The components are installed accordance with the description in the equipment list.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-04: Material Verification

Objective

Verify that materials that contact to PW (after EDI-01) are stainless steel 316L or other FDA approved material.

Procedure

1. Use the component list as the test record; If the required certificate is present, use yellow highlight to underline at the component name in the component list; otherwise write “Fail” and a deviation number.
2. Sign and date at the bottom of each page of the test record.
3. Attach the checked part list to the test report.

Required Document

1. Component List
2. Vendor Document Review

Required Measurement Instrument

N/A

Acceptance Criteria

1. Metal materials in contact with the product shall be SS 316L.
2. Material for non-metal materials in contact with the product shall comply with FDA regulations.
3. The checked reference document has been attached to the test report.

Test Result

Acceptance criteria	Test result pass acceptance criteria (Yes/No)
Metal materials in contact with the product shall be of SS 316L material certificates.	☐ Yes ☐ No, Deviation No._____
Material for non-metal materials in contact with the product shall comply with FDA regulations.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-05: Calibration Verification

Objective

Verify that all critical instruments have been calibrated with calibration certificate.

Procedure

1. Use the component list as the test record; If the required certificate is present, use yellow highlight to underline at the component name in the component list; otherwise write “Fail” and a deviation number.
2. Sign and date at the bottom of each page of the test record.
3. Attach the checked part list to the test report.

Required Document

1. Component List
2. Vendor Document Review

Required Measurement Instrument

N/A

Acceptance Criteria

1. Calibration certificates shall be present for the critical instruments.
2. The checked reference document has been attached to the test report.

Test Result

Acceptance Criteria	Test result pass acceptance criteria (Yes/No)
Calibration certificates shall be present for the installed instruments.	☐ Yes ☐ No, Deviation No._____
The checked reference document has been attached to the test report.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Test Name:	IQ-06: Verification of Weld Quality

Objective

Check the weld quality and the welding documents.

Procedure

1. Use the welding documents as the test file, including: welds drawing, welding log, endoscope inspection record, welder certificate, welding inspector certificate, welding machine certificate, report and so on;
2. All the documents comply with the as build system;
3. Record or attach all the referenced documents.

Required Document

1. Welding documents

Required Measurement Instrument

N/A

Acceptance Criteria

1. The welder and welding inspector are qualified with certificate.
2. The welding log is present and traceable.
3. The self-inspection must be carried out for at least 20% of the orbital welds and 100% of the manual welds.

Test Result

Verified Item	Acceptance Criteria	Test result pass acceptance criteria (Yes/No)
Welders and Welding Inspector Qualifications	Welders and inspectors' names are clearly identified. The welders are qualified for the welding job. The inspectors are qualified for the welding inspection job. The welding and inspection have been executed during the validity period of the certification.	☐ Yes ☐ No, Deviation No._____
Welds drawing	All welds are included in the welds Drawing.	☐ Yes ☐ No, Deviation No._____
Inspection of weld quality	At least 20% of the orbital welds and 100% of the manual welds (by endoscopy inspection).	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

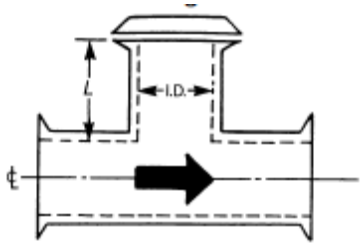
Test Name:	IQ-07: Verification of Dead-legs

Objective

Verify the potential dead-legs in the PW distribution system.

Procedure

1. Record the P&ID number of the valves and instruments (after EDI-01) which may have potential dead-legs.
2. Measure the dead-leg by the term L/D, where L is the leg extension from the I.D. wall normal to the flow pattern or direction, and D is the I.D. of the extension or leg of a tubing fitting or the nominal dimension of a valve or instrument. For valves, L shall be measured to the seal point of the valve. Record L/D ratio of all valves and instrument.



Required Document

1. P&ID of purified water distribution schematic (PWS-01)

Required Measurement Instrument

Measuring Tape

Acceptance Criteria

1. L/D ratio of all checked valves and instruments must less than 1.5

Test Result

Valve & Instrument	L (cm)	D (cm)	L/D ratio	Test result pass acceptance criteria (Yes/No)
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________
				☐ Yes ☐ No, Deviation No.__________

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-08: Verification of Draining Ability

Objective

Verify the drainage of the system by checking the slope of the pipelines.

Procedure

1. Check if there is the lowest positioned point in the system;
2. Measure the slope of all horizontal pipes and record the values on the isometric drawing or other documents.
3. Use yellow highlight to underline each pipeline that slope is > 1:100. If any non-conformance is found, mark with a blue ballpoint pen.
4. Sign and date at the bottom of the P&ID.
5. Attach the checked test record to the test report.

Required Document

N/A

Required Measurement Instrument

N/A

Acceptance Criteria

1. There must be one or more points through which the piping can be emptied. The lowest positioned points in the system must all have a drainage possibility.
2. Horizontal pipeline should have enough slope (>0.5%) to ensure drainage.

Test Result

Acceptance Criteria	The Acceptance Criteria is passed.
There must be one or more points through which the piping can be emptied. The lowest positioned points in the system must all have a drainage possibility.	☐ Yes ☐ No, Deviation No._____
Horizontal pipeline should have enough slope (>0.5%) to ensure drainage.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-09: Verification of Pressure Leak Test

Objective

Verify there is no any leakage during system running within the design pressure.

Procedure

Check the report of system pressure leak test.

Required Document

Report of system pressure leak test

Required Measurement Instrument

N/A

Required Analytical Method

N/A

Acceptance Criteria

1. The pressure gauge used is calibrated.
2. The pressure leak test has been available and completed with sign and date.
3. There is no leakage of connection pipes and components and the welding points under the pressure of design pressure at least for half an hour.

Test Result

Acceptance Criteria	The Acceptance Criteria is passed.
The pressure leak test has been available and completed with sign and date.	☐ Yes ☐ No, Deviation No._____
The test procedure shows the referenced standard.	☐ Yes ☐ No, Deviation No._____
There is no leakage of connection pipes and components and the welding points under the pressure of design pressure at least for half an hour.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-10: Verification of Cleaning and Passivation

Objective

Verify that cleaning and passivation have been completed before system start-up.

Procedure

1. Verify that relevant protocols and reports of cleaning and passivation must be available.
2. The cleaning report must record the cleaning time, the NaOH concentration, and the pH value after cleaning. The passivation report must record the time, treatment temperature and the concentration of the solution used for passivation.

Required Document

Passivation protocol and report

Required Measurement Instrument

N/A

Acceptance Criteria

1. The cleaning and passivation protocol must be adaptable and approved.
2. The cleaning and passivation have been completed, and the report is available and readable.

Test Result

Acceptance Criteria	The Acceptance Criteria is passed.
The cleaning and passivation protocol must be adaptable and approved.	☐ Yes ☐ No, Deviation No._____
The cleaning and passivation have been completed, and the report is available and readable.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-11: Verification of Utility Connection

Objective

Verify all utilities and record their operating parameters.

Procedure

Verify that all utilities necessary to the functioning of the system are correctly connected. Verify their operating parameters.

Required Document

Required Measurement Instrument

N/A

Acceptance Criteria

Utilities are correctly connected and identified and their operating parameters are in accordance with the design.

Test Result

Verified Item	Design Parameter	Actual Result	Actual result is in design range. (Yes/No)
021 Feed water in	$\geq$ 2.5 bar		☐ Yes ☐ No, Deviation No._____
051 Compressed air in	$\geq$ 6 bar		☐ Yes ☐ No, Deviation No._____
Electric power	380 V $\pm$10% V		☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

TEST SUMMARY

Test No.	Test Name	Result (Pass/Fail)	Deviation	
			No.	Closed Date
IQ-01	Documentation Verification			
IQ-02	P&ID Verification			
IQ-03	Component Verification			
IQ-04	Material Verification			
IQ-05	Calibration Verification			
IQ-06	Verification of Weld Quality			
IQ-07	Verification of Dead Legs			
IQ-08	Verification of Draining Ability			
IQ-09	Verification of Hydrostatic Test			
IQ-10	Verification of Cleaning and Passivation			
IQ-11	Verification of Utility Connection			

Performed By: _____ Date: _____

Reviewed By: _____ Date: _____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

6. DEVIATION LIST

Deviation No.		Priority	☐ Major ☐ Minor
Deviation to Test No.			

Description

Agreed Corrective Action

Responsible Person	
Expected Completion Date	

Remark

Completion by (Signature)		Date	
Approve Completion by (Signature)		Date	

NOTE: This sheet may be copied as necessary. Sheet _____of_____

Major = System/Equipment cannot be subjected to further testing before deviation is corrected.

Minor = System/Equipment can be subjected to further testing while deviation is corrected on site.

PROTOCOL AND REPORT

7. APPENDIX: ATTACHMENT LIST

No.	Document Name	Document No.	Attached to Test No.	Number of Page

NOTE: This sheet may be copied as necessary. Sheet _____of_____

Performed By: _____ Date: _____

Reviewed By: _____ Date: _____

PROTOCOL AND REPORT

Title: Installation Qualification of Purified Water System Unit 1 (PWS-01)

8. SUMMARY

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

TABLE OF CONTENTS

PROTOCOL AND REPORT

1. PURPOSE

The objective of this protocol is to provide documented evidence that:

1) The system's critical operational and functional characteristic conform to the user's requirements as laid down in the design specification
2) The system's critical operational and functional characteristic can be executed correctly as per design specifications or manufacturer's recommendations and are suitable for their intended use.

The documentation, as specified in this protocol is available, adequate and of appropriate quality.

2. DEFINITION / ABBREVIATION

IQ	Installation Qualification
OQ	Operational Qualification
P&ID	Piping & Instrumentation Diagram
PW	Purified Water
POU	Point of Use
FE	Facility and Engineering Department
VA	Validation Department
QA	Quality Assurance Department

3. REFERENCE

3.1 *Good Manufacturing Practices for Modern Pharmaceutical Products, Laws of Thai Ministry of Public Health, Food and Drug Administration (FDA), B.E. 2554*

3.2 *WHO Good Manufacturing Practices: Water for Pharmaceutical Use, WHO Technical Report Series, No. 970,* 2012, Annex 2

3.3 *ISPE Baseline Guide: Volume 5 - Commissioning and Qualification,* International Society for Pharmaceutical Engineering, 2001.

3.4 *ISPE Baseline® Guide: Volume 4 – Water and Steam Systems,* International Society for Pharmaceutical Engineering, 2001.

3.5 Pharmaceutical Inspection Cooperation Scheme (PIC/S), *Inspection of Utilities,* PI 009-3, 25 September 2007

3.6 *Construction Completion Pre-commissioning & Commissioning Dossier: Purified Water System, MWZ/526143/ M-009*, Volume 1 of 1, April 2009

3.7 *Operation & Maintenance Manual: Purified Water System, 1/2 COPY No. 2, MWZ/526143/O&M / M-009*, Volume 1-2, 405p, June 2009

3.8 *Operation & Maintenance Manual: Purified Water System, 2/2 COPY No. 2, MWZ/526143/O&M / M-009*, Volume 1-2, 483p, June 2009

4. SYSTEM OVERVIEW / SPECIFICATION

4.1 General

The Purified Water System Unit 1, (PWS-01) comprises of Water Pre-treatment, RO/EDI skid, 2000L Purified Water Tank, PW distribution loop and related instruments, and is located in PW room. The PWS-01 generated will be distributed to 5 points of use in General Bioprocess 1 (Unit 1). Moreover the PW from this unit is used as feed water to produce Pure Steam (PS) and Water for Injection (WFI) in unit WFIS-01. The loop velocity is not lower than 1m/s to prevent biofilm generation. The Purified Water System unit 1is used in production process that is product contact system which is considered as Direct Impact system according to ISPE baseline pharmaceutical engineering guide, volume 5 commissioning and qualification. Only component that has impact to quality of PW is considered as critical component. The process block diagram that shows production process of PW is illustrated in Figure 1.

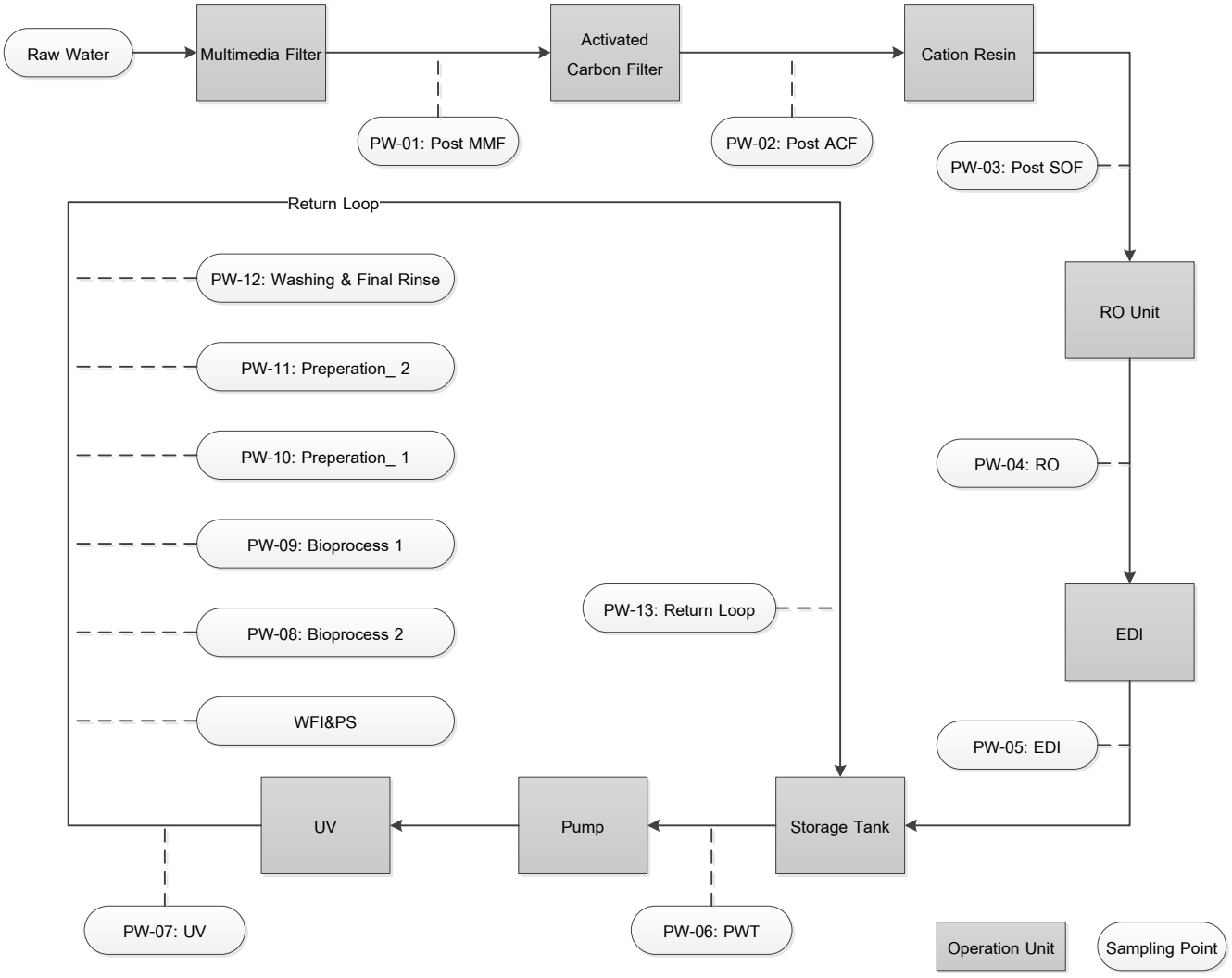


Figure 1 Production Process of Purified Water System Unit 1 (PWS-01)

The system is covered in the following Piping & Instrumentation Diagram (P&ID):

UP00003	Purified Water System Schematic
UP00004	Purified Water Distribution Schematic

4.2 Critical component

Component Name	Component Code	Function
Activated Carbon Filter	ACF-01	Remove color, odor, chlorine and reduce organic matter
RO unit	RO-01	Reduce inorganic contaminants, organic contaminants, colloids, microorganisms, endotoxin
EDI unit	EDI-01	Reduce ionic matters
PW Storage Tank	PWT-01	Storage PW and maintain quality of PW
Air vent filter	N/A	Filter air inlet and outlet of PW storage tank
Spray ball	N/A	Rinse and wet interior surface of PW storage tank
PW Pump	PWP-01	Deliver PW with specified flowrate
Piping System	N/A	Deliver PW to point of use
UV	UV-02	Control bioburden and oxidize ozone in sanitization mode of distribution loop
Ozone generator	OZ-01	Sanitize distribution loop

6.3 Critical instrument

Component Name	Component Code	Function
Level transmitter	LE-2401	Measure level of PW in storage tank to control PW generator
Conductivity sensor	CE-2401	Measure conductivity of generated PW and trigger drain function when conductivity of generated PW is higher than set point
Conductivity sensor	CE-2402	Measure conductivity of distribution loop at return loop
Ozone sensor	OZ-2401	Measure ozone concentration in sanitization mode of distribution loop
Flow sensor	FE-2401	Measure and control PW flowrate in distribution loop

PROTOCOL AND REPORT

The qualification tests are listed as following:

Test No.	Test Name
OQ-01	Pre-Requisite Check
OQ-02	Coverage Test
OQ-03	Power Break Test
OQ-04	Functional Test
OQ-05	Operating Parameter Verification
OQ-06	Productivity Test
OQ-07	Performance Test

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

5. QUALIFICATION TEST

Test Name:	OQ-01: Pre-requisite check

Objective

1. To verify that the installation qualification is available and approved.

Procedure

1. Check that the installation qualification has been approved with sign and date.

Required Document

See the result table

Required Measurement Instrument

N/A

Acceptance Criteria

1. The installation qualification is available, complete and approved with sign and date.

Test Result(s)

Acceptance Criteria	Results (Pass/Fail)
The installation qualification is available, complete and approved with sign and date.	☐ Pass ☐ Fail

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Test Name:	OQ-02: Coverage Test

Objective

1. To provide documented evidence to demonstrate that spray ball is able to rinse and wet all internal surface of the PW storage tank effectively.

Procedure

1. Visually inspect the internal surface of the PW storage tank with a lamp.

Required Document

N/A

Required Measurement Instrument

N/A

Acceptance Criteria

1. Spray ball is able to rinse and wet all internal surface of the PW storage tank.

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Result

Acceptance Criteria	Results (Pass/Fail)
Spray ball is able to rinse and wet all internal surface of the PW storage tank.	☐ Pass ☐ Fail

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Test Name:	OQ-03: Power Break Test

Objective

Verify the system behavior after an electrical power loss.

Procedure

1. Start up the system, and record the key parameters of the control system. Shutdown the power supply, wait for a minute and then restore the power.
2. Verify recovery procedure that the control screen is on but the system operation does not start automatically (without operator's command).
3. Verify that no functional anomalies are present.
4. Record the control system parameters setting and verify data with the previous record (before black out).

Required Document

N/A

Required Measurement Instrument

N/A

Acceptance Criteria

1. When power is restored, the system operation does not start automatically.
2. When power is restored, the system resumes its regular functioning without anomalies and setup parameters do not show modifications.
3. The parameters of system before and after an electrical power loss are attached to the test report.

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Result(s)

Acceptance Criteria	Results (Pass/Fail)
When power is restored, the system operation does not start automatically.	☐ Pass ☐ Fail
No functional abnormalities have been verified.	☐ Pass ☐ Fail
Recovery procedures are normal. System maintains original parameters settings.	☐ Pass ☐ Fail

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	IQ-04: Functional Test

Objective

1. To verify that the critical function of operation is in accordance with its design specification. All function and alarm test have been done in commissioning.
2. To verify that setting and operating parameter is within design parameter ranges.

Procedure

1. Perform the test function as in the test result table and record whether it is complied with its program or not.
2. During operation with setting parameter, record operating parameter in the test result table.

Required Document

N/A

Required Measurement Instrument

N/A

Acceptance Criteria

1. All test result is according to the expected result for all functional tests.
2. All operating parameters are in design parameter range as shown in the test result table.

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Result

Test Action	Expecting Result	Test result (Pass/Fail)	Verified by: Signature & Date
1. Pre-requisite Procedure			
Operate PW system in automatic mode for 15 minutes without alarm and malfunction.	N/A	N/A	N/A
2. Functional Test			
Mode: Purified Water Supply (PW conductivity is lower than set point (0.8 µS/cm)).	PW supply valve open. The water is discharged to the Purified Water Tank.	☐ Pass ☐ Fail	
	The EDI Drain valve close. The water is not discharged to drain.	☐ Pass ☐ Fail	
Mode: Purified Water Distribution system (Non Sanitized).	The purified water pump is on operation.	☐ Pass ☐ Fail	
	The UV-02 is on operation.	☐ Pass ☐ Fail	
	The Instrument display panel is on operation, Value is shown: Water Conductivity, Ozone Concentration, Loop return flow.	☐ Pass ☐ Fail	
Mode: Purified Water Distribution system (Sanitization).	PWP-01and OZ-01 are on operation.	☐ Pass ☐ Fail	
	The Instrument display panel is on operation, Value is shown: Water Conductivity, Ozone Concentration, Loop return flow.	☐ Pass ☐ Fail	
Mode: Purified Water Drain (PW conductivity is higher than set point (0.8 µS/cm)).	The EDI Drain valve open. The water is not discharged to drain. PW supply valve close. The water is not discharged to the Purified Water Tank.	☐ Pass ☐ Fail	

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Result

Test Action	Expecting Result	Test result (Pass/Fail)	Verified by: Signature & Date
The tank level is low.	The RO/EDI skid will be automatically started.	☐ Pass ☐ Fail	
	The RO flushing duration is according to the setting timer (10 minutes).	☐ Pass ☐ Fail	
The tank level is low low.	The purified water pump of distribution loop is stop.	☐ Pass ☐ Fail	
The tank level is high.	The RO/EDI stops production of PW.	☐ Pass ☐ Fail	
	The PW in the PW storage tank recirculate to RO for flushing and maintain the flow through RO membrane periodically (every 2 hours).	☐ Pass ☐ Fail	
	The RO flushing duration is according to the setting timer (10 minutes).	☐ Pass ☐ Fail	
3. Alarm Test			
EDI Conductivity High If the EDI dilution outlet conductivity is higher than set point (0.8 µS/cm), duration longer than setting time (5 minutes).	The RO/EDI system will be trip and alarm. Screen shows “EDI Conduct High”.	☐ Pass ☐ Fail	
Low water supply pressure (no raw water)	The RO/EDI skid will be trip and alarm. Screen shows “RO H/L pressure stop”.	☐ Pass ☐ Fail	
EDI low flow	The RO/EDI skid will be trip and alarm. Screen shows “EDI low flow”.	☐ Pass ☐ Fail	

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Test Name:	IQ-05: Operating Parameter Verification

Objective

1. To verify that setting and operating parameter are within design parameter ranges.

Procedure

1. Operate system in automatic mode for 15 minutes without alarm and malfunction.
2. During operation with setting parameter, record operating parameter in the test result table.

Required Document

N/A

Required Measurement Instrument

N/A

Acceptance Criteria

1. All operating parameters are in design parameter range as shown in the test result table.

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Result

Parameter	Unit	Design Value	Actual Value	Test result (Pass/Fail)
Setting Parameter				
HP pump inlet pressure SW cut-off/on	Bar	0.3/1	N/A	N/A
HP pump discharge pressure SW cut-off/on	Bar	11/12	N/A	N/A
RO permeate pressure SW cut-off/on	Bar	2.8/3.5	N/A	N/A
EDI flow switch cut-off/on	l/h	<1300/>1300	N/A	N/A
Conductivity output cut-off/on	µS/cm	<0.8/>0.8	N/A	N/A
Operating Parameter				
Multimedia filter inlet pressure (PG-2401)	Bar	≥ 2.5		☐ Pass ☐ Fail
Carbon filter inlet pressure (PG-2403)	Bar	≥ 2.5		☐ Pass ☐ Fail
Softener filter inlet pressure (PG-2405)	Bar	≥ 2.5		☐ Pass ☐ Fail
5 micron filter inlet pressure (PG-2407)	Bar	1-3		☐ Pass ☐ Fail
5 micron filter outlet pressure (PG-2408)	Bar	1-3		☐ Pass ☐ Fail
Membrane inlet pressure (PG-2409)	Bar	7-12		☐ Pass ☐ Fail
Membrane outlet pressure (PG-2410)	Bar	7-12		☐ Pass ☐ Fail
RO permeate flow (FI-2403)	l/h	1500-2200		☐ Pass ☐ Fail
RO brine flow (FI-2402)	l/h	1200-1500		☐ Pass ☐ Fail
RO circulate flow (FI-2401)	l/h	3500-2500		☐ Pass ☐ Fail
EDI electrolyte inlet pressure (PG-2413)	Bar	≤3		☐ Pass ☐ Fail
EDI concentrate inlet pressure (PG-2411)	Bar	≤3		☐ Pass ☐ Fail
EDI feed pressure (PG-2412)	Bar	≤3		☐ Pass ☐ Fail
EDI electrolyte flow (FI-2405)	l/h	11-13		☐ Pass ☐ Fail
EDI concentrate flow (FI-2404)	l/h	10% of FI-2406		☐ Pass ☐ Fail
EDI flow product (FI-2406)	l/h	1300-2300		☐ Pass ☐ Fail
EDI DC supplied voltage	Volt	280-300		☐ Pass ☐ Fail
EDI DE supplied current	Amp	1-5		☐ Pass ☐ Fail
EDI product conductivity (CE-2401)	µS/cm	≤0.8		☐ Pass ☐ Fail

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	OQ-06: Capacity Test

Objective

1. To provide documented evidence to demonstrate that a minimum of 1,750 l/hr is generated from PW system.
2. To provide documented evidence to demonstrate that a minimum of 1,750 l/hr is supplied from PW distribution system when 3 points of use are opened simultaneously.

Procedure

1. Operate system for 15 minutes without alarm prior to test.
2. Record PW flowrate after EDI every 15 minutes for 1 hour.
3. Open 3 points of use simultaneously and collect 50L of PW and record time of collecting.

Required Document

N/A

Required Measurement Instrument

N/A

Acceptance Criteria

1. The flowrate from PW generator to PW tank is not lower than 1,750 l/hr.
2. The supply flowrate of PW from storage tank to point of use is not lower than 1,750 l/hr when 3 points of use are opened simultaneously.

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Result		
Generating Capacity		
15 min, At _____._____	Measured flowrate from FI-2406 is _____l/h.	
30 min, At _____._____	Measured flowrate from FI-2406 is _____l/h.	
45 min, At _____._____	Measured flowrate from FI-2406 is _____l/h.	
60 min, At _____._____	Measured flowrate from FI-2406 is _____l/h.	
Supply Capacity		
1. Room No._____ POU No._____	50L of PW is collected in _____min.	Calculated flowrate is _____l/h.
2. Room No._____ POU No._____	50L of PW is collected in _____min	Calculated flowrate is _____l/h.
3. Room No._____ POU No._____	50L of PW is collected in _____min.	Calculated flowrate is _____l/h.
		Total flowrate is _____l/h.

Acceptance criteria	Results (Pass/Fail)
1. Generating capacity is ≥ 1,750 l/h.	☐ Pass ☐ Fail
2. Supply capacity is ≥ 1,750 l/h.	☐ Pass ☐ Fail

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Name:	OQ-07: Performance Test

Objective

1. To provide documented evidence to demonstrate that conductivity of PW at the outlet of PW generator and return to tank as intended during operation.
2. To provide documented evidence to demonstrate that PW velocity in distribution loop is higher than 1 m/s.

Procedure

1. Operate system for 15 minutes without alarm prior to test in recirculation mode.
2. Record the conductivity at CE-2401 and CE-2402 every 15 minutes for 1 hour.
3. Use Table in the acceptance criteria, find the closet temperature value that is not greater than the measured temperature and record in the test result table.
4. Open 3 points of use simultaneously and record flowrate at return point to the storage tank (at FE-2401) then calculate velocity.

Required Document

See the result table

Required Measurement Instrument

N/A

Acceptance Criteria

1. The conductivity for CE-2401 (without temperature compensation) is not over than limit in below table.

Temperature (°C)	20	25	30	35	40
Conductivity (μS/cm)	1.1	1.2	1.3	1.4	1.5

2. The conductivity is not more than 1.3 μS/cm at 25°C for CE-2402.
3. The PW velocity is not less than 1 m/s when 3 POUs are opened.

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Test Result

Conductivity aspect

Time	Conductivity at CE 2401		Conductivity at CE 2402
	Measured Value	Conductivity limit at closet temperature that is not greater than measured temperature	
15 min _____._____	_____µS/cm At _____°C.	_____µS/cm	_____µS/cm At 25°C.
30 min _____._____	_____µS/cm At _____°C.	_____µS/cm	_____µS/cm At 25°C.
45 min _____._____	_____µS/cm At _____°C.	_____µS/cm	_____µS/cm At 25°C.
60 min _____._____	_____µS/cm At _____°C.	_____µS/cm	_____µS/cm At 25°C.

Velocity aspect

Recorded flowrate when 3 POUs are opened is _____l/h.

Calculated PW velocity is _____m/s.

Acceptance Criteria	Acceptance Criteria is met (Yes/No)
The conductivity is not more than 1.3 µS/cm at 25°C.	☐ Yes ☐ No
The PW velocity data are not less than 1 m/s when 3 POUs are opened.	☐ Yes ☐ No

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

6. TEST SUMMARY

Test No.	Test Name	Result (Pass/Fail)	Deviation	
			No.	Closed Date
OQ-01	Pre-Requisite Check			
OQ-02	Coverage Test			
OQ-03	Power Break Test			
OQ-04	Functional Test			
OQ-05	Operating Parameter Verification			
OQ-06	Productivity Test			
OQ-07	Performance Test			

Performed By: _____ Date: _____

Reviewed By: _____ Date: _____

PROTOCOL AND REPORT

7. DEVIATION LIST

Deviation No.		Priority	☐ Major ☐ Minor
Deviation to Test No.			

Description

Agreed Corrective Action

Responsible Person	
Expected Completion Date	

Remark

Completion by (Signature)		Date	
Approve Completion by (Signature)		Date	

NOTE: This sheet may be copied as necessary. Sheet _____of_____

Major = System/Equipment cannot be subjected to further testing before deviation is corrected.

Minor = System/Equipment can be subjected to further testing while deviation is corrected on site.

PROTOCOL AND REPORT

Title: Operational Qualification of Purified Water System Unit 1 (PWS-01)

8. APPENDIX: ATTACHMENT LIST

No.	Document Name	Document No.	Attached to Test No.	Number of Page

NOTE: This sheet may be copied as necessary. Sheet _____of_____

Performed By: _____ Date: _____

Reviewed By: _____ Date: _____

9. SUMMARY

เอกสารแนบ 2

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Protocol Approval

	Signature (Name)	Title	Date
Prepared by:			
Reviewed/Approved by:			
Reviewed/Approved by:			
Approved by:			
Approved by:			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

QUALIFICATION REPORT

Report Approval

	Signature (Name)	Title	Date
Prepared by:			
Reviewed/Approved by:			
Reviewed/Approved by:			
Approved by:			
Approved by:			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

TABLE OF CONTENTS

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

1. PURPOSE

The objective of this protocol is to provide documented evidence that:

1) The system's installations conform to the user's requirements as laid down in the design specification.
2) The system's installations are executed correctly as per design specifications or manufacturer's recommendations and are suitable for their intended use.
3) The documentation, as specified in this protocol is available, adequate and of appropriate quality.

2. DEFINITION / ABBREVIATION

IQ	Installation Qualification
OQ	Operational Qualification
P&ID	Piping & Instrumentation Diagram
FE	Facility and Engineering Department
VA	Validation Department
QA	Quality Assurance Department

3. REFERENCE

5.1 *Good Manufacturing Practices for Modern Pharmaceutical Products*, B.E. 2554, Laws of Thai Ministry of Public Health Food and Drug Administration (FDA)

5.2 ISO 8573-1:2010 *Compressed air -- Part 1: Contaminants and purity classes*

5.3 Pharmaceutical Inspection Cooperation Scheme (PIC/S), *Inspection of Utilities*, PI 009-3, 25 September 2007

5.4 *ISPE Baseline Guide: Volume 5 - Commissioning and Qualification,* International Society for Pharmaceutical Engineering, 2001.

5.5 *Construction Completion Pre-commissioning & Commissioning Dossier: Compressed Dry Air System, MWZ/526143/ M-006*, Volume 1 of 1, April 2009

5.6 *Operation & Maintenance Manual: Compressed Dry Air System, MWZ/526143/ O&M / M-006, Volume 1 of 1*, June 2009

4. SYSTEM OVERVIEW / SPECIFICATION

6.1 General

Compressed dry air system (CDAS-01) is designed to supply 6 m^3/min at 7 bar of oil-free compressed dry air accordance with ISO standard for compressed air ISO-8573 Class 1.4.3 to the facility as instrument air and process air (product contact). The CDA system is product contact system which is considered as Direct Impact system according to ISPE baseline pharmaceutical engineering guide, volume 5 commissioning and qualification.

The air compressor and its associated accessories are located in Machine Room in the NBF building. The CDA system is comprised of an air compressor unit, supplied with associated equipment which is receiving tank, filters, air dryer. Process block diagram of production of CDA is shown in Figure 1. Appropriate terminal sterile filters are installed at the point of use for process air – e.g. fermentor, autoclave, media for integrity test.

Table 1 Specification of CDA according to ISO 8573 Class 1.4.3

Parameter	Specification
Pressure	$\geq$ 6 bar
Particle limit	Particle size 0.1 - 0.5 micron: NMT 20,000 particles/Nm^3 Particle size 0.5 - 1.0 micron: NMT 400 particles/Nm^3 Particle size 1.0 – 5.0 micron: NMT 10 particles/Nm^3
Vapour pressure dew point	$\leq$ 3 °C
Residual oil content	$\leq$ 1 mg/m^3

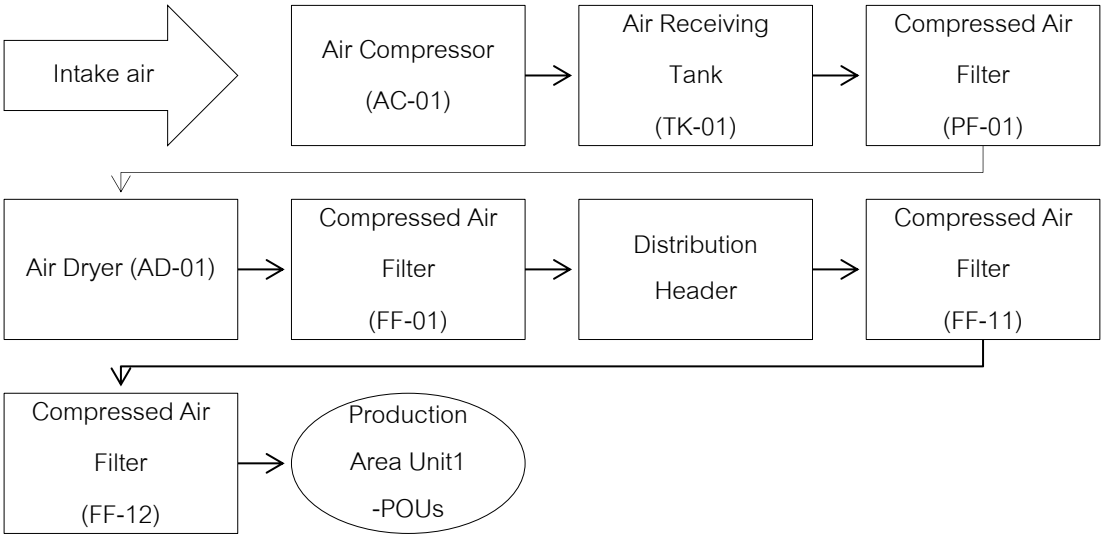


Figure 1 Process Block Diagram of Production of CDA

The system is covered in the following Piping & Instrumentation Diagram (P&ID):

UA00003-AS	CDA system schematic
UA00004-AS	CDA distribution schematic

6.2 Critical System Components

The following components are comprehensive component of the CDA system. The piping and fitting after final filter (FF-12) have been considered as critical that directly or indirectly impact to product quality.

Component	Function
AC-01 Air compressor	Generate compressed air to 7 bar at 6 m^3/min.
TK-01 Air receiving tank	Storage of compressed air
AD-01 Air dryer	Removal of moisture
FF-01 Compressed Air Filter	Removal of particle up to 0.01 micron and max concentration of oil is 0.01 mg/m^3
FF-12 Compressed Air Filter	Removal of particle up to 0.01 micron and max concentration of oil is 0.01 mg/m^3
Piping and fitting after final filter FF-12	**Critical Components: Maintain quality of compressed dry air**

6.3 Release Condition

To release the CDA system for GMP operation, the qualification activities as shown below must be completed.

Test Plan	Qualification Item	Acceptance Criteria
Verify the documentation system including operating and maintenance manual, drawings,	IQ-01	Approved IQ Protocol and Summary Report
Verify the installation according to P&ID, layout and component list	IQ-02, IQ-03	
Verify for availability to clean and maintenance	IQ-02	
Verification of material for critical equipment	IQ-06	
Verification of calibration	IQ-04	
Pressure hold test	IQ-05	
Verify alarm and function	OQ-01	Approved OQ Protocol and Summary Report
Verify quantity specification	OQ-02	
Verify quality specification	PQ	Approved PQ Protocol and Summary Report

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

The qualification tests are listed as following:

Test No.	Test Name
IQ-01	Document Verification
IQ-02	P&ID Verification
IQ-03	Verification of Equipment
IQ-04	Calibration Verification
IQ-05	Pressure Leak Test
IQ-06	Verification of Material

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

5. QUALIFICATION TEST

Test Name:	IQ-01: Documentation Verification

Objective

To verify the availability and the completion of the documentation.

Procedure

Verify that documents listed in the test result table are available and complete.

Required Document

N/A

Required Material/Measurement Instrument

N/A

Acceptance Criteria

Each document is provided, all required documents are available and complete.

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Test Result

Document Name	Document No. and Revision No.	Available and complete (Yes/No)
CDA SYSTEM SCHEMATIC		☐ Yes ☐ No, Deviation No._____
CDA DISTRIBUTION SCHEMATIC		☐ Yes ☐ No, Deviation No._____
Commissioning Document		☐ Yes ☐ No, Deviation No._____
Design Review Document		☐ Yes ☐ No, Deviation No._____
Operation & Maintenance Manuals		☐ Yes ☐ No, Deviation No._____
EQUIPMENT LIST		☐ Yes ☐ No, Deviation No._____
SPARE PART LIST		☐ Yes ☐ No, Deviation No._____
Vendor Document Review		☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Test Name:	IQ-02: P&ID Verification

Objective

1. Verify that the installation of CDAS-01 conforms to the final P&ID.
2. Verify that the installed equipment is able to access to sampling, clean and maintenance.

Procedure

1. Compare the P&ID with the system. Use yellow highlight to underline each equipment, device, component, line, direction, tag (equipment identification label) and instrument in accordance with the relevant drawing. Use a blue ball point pen to update the P&ID in order to accurately represent the final installation of the equipment.
2. Sign and date on the bottom of checked P&ID and attach to this report.
3. Attach the updated P&ID to the test report if applicable.

Required Document

1. CDA system schematic
2. CDA distribution schematic

Required Measurement Instrument

N/A

Acceptance Criteria

1) The P&ID is in accordance to the as-built system;
2) All equipment, devices and equipment are correctly identified and labeled;
3) All equipment, devices and equipment are able to access to sampling, clean and maintenance.

Test Result

Test topic	Test result pass acceptance criteria (Yes/No)
The installation is in accordance with P&ID.	☐ Yes ☐ No, Deviation No._____
All equipment, piping and instruments have been identified and tagged properly.	☐ Yes ☐ No, Deviation No._____
All equipment, devices and components are able to access to sampling, clean and maintenance.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Test Name:	IQ-03: Verification of Equipment

Objective

1. Verify that the installed valves, instruments and other components are in accordance with the description in the component list.

Procedure

1. Use the equipment list as the test file; compare the installed equipment with the equipment list in respect of equipment model, technical data, etc. If the actual equipment is in compliance with the description, use yellow highlight to underline at the equipment name in the equipment list; otherwise use blue ballpoint pen to correct information and raise a deviation.
2. Sign and date at the bottom of each page of the equipment list.
3. Attach the checked equipment list to the test report.

Required Document

1. Equipment List
2. Equipment Catalogue (Operation and maintenance manual of CDA system, Doc. No. MWZ/562143/O&MM-006)

Required Measurement Instrument

N/A

Acceptance Criteria

1. The installed equipment are in accordance with the description in the equipment list. The checked reference document has been attached to the test report.

Test Result

Acceptance Criteria	Test result pass acceptance criteria (Yes/No)
The equipment are installed accordance with the description in the equipment list.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Test Name:	IQ-04: Calibration Verification

Objective

Verify that all critical instruments have been calibrated with calibration certificate.

Procedure

1. Use the equipment list as the test record; If the required certificate is present, use yellow highlight to underline at the equipment name in the equipment list; otherwise write “Fail” and a deviation number.
2. Sign and date at the bottom of each page of the test record.
3. Attach the checked equipment list to the test report.

Required Document

1. Equipment List

Required Measurement Instrument

N/A

Acceptance Criteria

1. Calibration certificates shall be present for the critical instruments.
2. The checked reference document has been attached to the test report.

Test Result

	Test result pass acceptance criteria (Yes/No)
Calibration certificates shall be present for the installed instruments.	☐ Yes ☐ No, Deviation No._____
The checked reference document has been attached to the test report.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Test Name:	IQ-05: Pressure Leak Test

Objective

Verify there is no any leakage during system running within the design pressure.

Procedure

1. Verify that the pressure leak test has been performed and passed for piping using commissioning document. Record into test result table.

Required Document

1. Commissioning Document of CDA system (Document No. MWZ/562143/M-006)

Required Measurement Instrument

N/A

Acceptance Criteria

1. The pressure leak test has been performed for piping with documented evidence.
2. All pressure leak test is passed with signature and date.

Test Result

Acceptance Criteria	Test result pass acceptance criteria (Yes/No)
The pressure leak test has been performed for piping with documented evidence.	☐ Yes ☐ No, Deviation No._____
All pressure leak test is passed with signature and date.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Test Name:	IQ-06: Verification of Material

Objective

Verify that materials that contact to CDA (after FF-22) are stainless steel 304 or other equivalent or better material or other FDA approved material.

Procedure

1. Use the equipment list as the test file; If the required certificate or catalogue is present, use yellow highlight to underline at the equipment name in the equipment list; otherwise write “Fail” and a deviation number.
2. Sign and date at the bottom of each page of the part list.
3. Attach the checked part list to the test report.

Required Document

1. Equipment list

Required Measurement Instrument

N/A

Acceptance Criteria

1. Metal materials in contact with the product shall be SS304.
2. Material for non-metal materials in contact with the product shall comply with FDA regulations.
3. The checked reference document has been attached to the test report.

Test Result

Acceptance criteria	Test result pass acceptance criteria (Yes/No)
Metal materials in contact with the product shall be of SS304 material certificates.	☐ Yes ☐ No, Deviation No._____
Material for non-metal materials in contact with the product shall comply with FDA regulations.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

6. TEST SUMMARY

Test No.	Test Name	Result (Pass/Fail)	Deviation	
			No.	Closed Date
IQ-01	Document Verification			
IQ-02	P&ID Verification			
IQ-03	Verification of Equipment			
IQ-04	Calibration Verification			
IQ-05	Pressure Leak Test			
IQ-06	Verification of Material			

Performed By: _____ Date: _____

Reviewed By: _____ Date: _____

PROTOCOL AND REPORT

Title: Installation Qualification of Compressed Dry Air System

7. DEVIATION LIST

Deviation No.		Priority	☐ Major ☐ Minor
Deviation to Test No.			

Description

Agreed Corrective Action

Responsible Person	
Expected Completion Date	

Remark

Completion by (Signature)		Date	
Approve Completion by (Signature)		Date	

NOTE: This sheet may be copied as necessary. Sheet _____of_____

Major = System/Equipment cannot be subjected to further testing before deviation is corrected.

Minor = System/Equipment can be subjected to further testing while deviation is corrected on site.

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

Protocol Approval

	Signature (Name)	Title	Date
Prepared by:			
Reviewed/Approved by:			
Reviewed/Approved by:			
Approved by:			
Approved by:			

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

QUALIFICATION REPORT

Report Approval

	Signature (Name)	Title	Date
Prepared by:			
Reviewed/Approved by:			
Reviewed/Approved by:			
Approved by:			
Approved by:			

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

TABLE OF CONTENTS

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

1. PURPOSE

The objective of this protocol is to provide documented evidence that:

1) The system's operational and functional characteristic conforms to the user's requirements as laid down in the design specification.
2) The system's operational and functional characteristic can be executed correctly as per design specifications or manufacturer's recommendations and are suitable for their intended use.
3) The documentation, as specified in this protocol is available, adequate and of appropriate quality.

2. DEFINITION / ABBREVIATION

IQ	Installation Qualification
OQ	Operational Qualification
P&ID	Piping & Instrumentation Diagram
FE	Facility and Engineering Department
VA	Validation Department
QA	Quality Assurance Department

3. REFERENCE

5.1 *Good Manufacturing Practices for Modern Pharmaceutical Products*, B.E. 2554, Laws of Thai Ministry of Public Health, Food and Drug Administration (FDA)

5.2 ISO 8573-1:2010 *Compressed air -- Part 1: Contaminants and purity classes*

5.3 Pharmaceutical Inspection Cooperation Scheme (PIC/S), *Inspection of Utilities*, PI 009-3, 25 September 2007

5.4 *ISPE Baseline Guide: Volume 5 - Commissioning and Qualification,* International Society for Pharmaceutical Engineering, 2001.

5.5 *Construction Completion Pre-commissioning & Commissioning Dossier: Compressed Dry Air System, MWZ/526143/ M-006*, Volume 1 of 1, April 2009

5.6 *Operation & Maintenance Manual: Compressed Dry Air System, MWZ/526143/ O&M / M-006, Volume 1 of 1*, June 2009

4. SYSTEM OVERVIEW / SPECIFICATION

6.1 General

Compressed dry air system (CDAS-01) is designed to supply 6 m^3/min at 7 bar of oil-free compressed dry air accordance with ISO standard for compressed air ISO-8573 Class 1.4.3 to the facility as instrument air and process air (product contact). The CDA system is product contact system which is considered as Direct Impact system according to ISPE baseline pharmaceutical engineering guide, volume 5 commissioning and qualification.

The air compressor and its associated accessories are located in Machine Room in the NBF building. The CDA system is comprised of an air compressor unit, supplied with associated equipment which is receiving tank, filters, air dryer. Process block diagram of production of CDA is shown in Figure 1. Appropriate terminal sterile filters are installed at the point of use for process air – e.g. fermentor, autoclave, media for integrity test.

Table 1 Specification of CDA according to ISO 8573 Class 1.4.3

Parameter	Specification
Pressure	$\geq$ 6 bar
Particle limit	Particle size 0.1 - 0.5 micron: NMT 20,000 particles/Nm^3 Particle size 0.5 - 1.0 micron: NMT 400 particles/Nm^3 Particle size 1.0 – 5.0 micron: NMT 10 particles/Nm^3
Vapour pressure dew point	$\leq$ 3 °C
Residual oil content	$\leq$ 1 mg/m^3

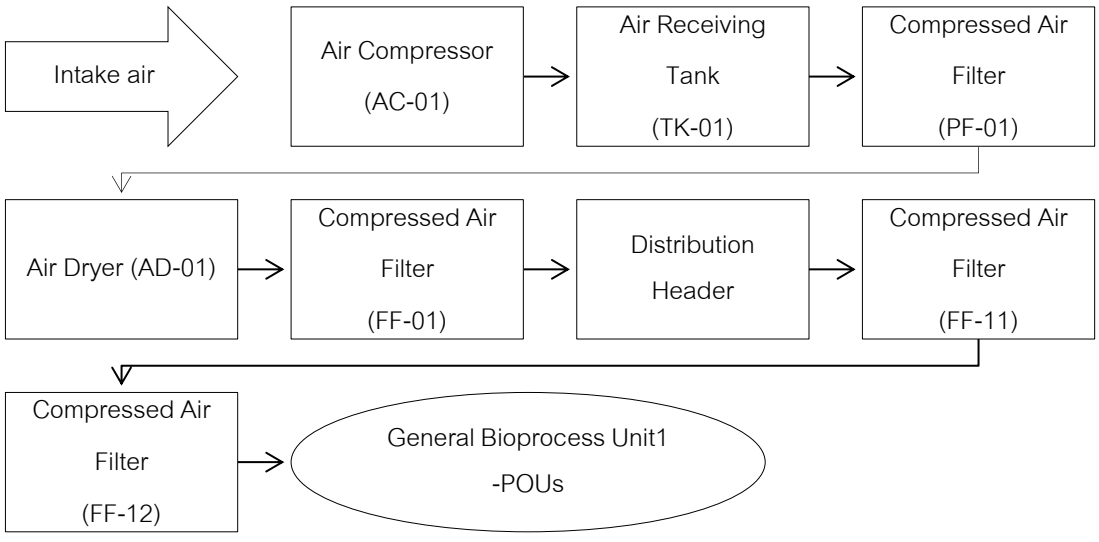


Figure 1 Process Block Diagram of Production of CDA

The system is covered in the following Piping & Instrumentation Diagram (P&ID):

UA00003-AS	CDA system schematic
UA00004-AS	CDA distribution schematic

6.2 Critical System Components

The following components are comprehensive component of the CDA system. The piping and fitting after final filter (FF-12) have been considered as critical that directly or indirectly impact to product quality.

Component	Function
AC-01 Air compressor	Generate compressed air to 7 bar at 6 m^3/min.
TK-01 Air receiving tank	Storage of compressed air
AD-01 Air dryer	Removal of moisture
FF-01 Compressed Air Filter	Removal of particle up to 0.01 micron and max concentration of oil is 0.01 mg/m^3
FF-12 Compressed Air Filter	**Removal of particle up to 0.01 micron and max concentration of oil is 0.01 mg/m^3 Critical Components: Build quality of compressed dry air**
Piping and fitting after final filter FF-12	**Critical Components: Maintain quality of compressed dry air**

6.3 Release Condition

To release the CDA system for GMP operation, the qualification activities as shown below must be completed.

Test Plan	Qualification Item	Acceptance Criteria
Verify the documentation system including operating and maintenance manual, drawings,	IQ-01	Approved IQ Protocol and Summary Report
Verify the installation according to P&ID, layout and component list	IQ-02, IQ-03	
Verify for availability to clean and maintenance	IQ-02	
Verification of material for critical equipment	IQ-06	
Verification of calibration	IQ-04	
Pressure hold test	IQ-05	
Verify alarm and function	OQ-01	Approved OQ Protocol and Summary Report
Verify quantity specification	OQ-02	
Verify quality specification	PQ	Approved PQ Protocol and Summary Report

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

The qualification tests are listed as following:

Test No.	Test Name
OQ -01	Functional Test
OQ -02	Performance Test

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

5. QUALIFICATION TEST

Test Name:	OQ-01: Functional Test

Objective

1. To verify the critical automatic function of system are in accordance with functional specification.
2. To verify the alarm function.

Procedure

Perform the test function in the test result table and record whether it is complied with its program or not.

Required Document

N/A

Required Material/Measurement Instrument

N/A

Acceptance Criteria

All test result is according to the expected result for all functional tests.

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

Test Result

Test Action and Record	Expecting Result	Test result pass acceptance criteria (Yes/No)
Pre-requisite Operate CDA system in normal operation mode for 15 minutes without alarm and malfunction.		
Operation of air compressor		
1. Set low pressure limit setpoint and record value. 2. Open valve to relieve pressure until pressure drop below set point. Set point for low pressure limit is _____bar.	The compressor starts operation when pressure reaches set point for low pressure limit. Pressure when the compressor starts operation is _____ bar.	☐ Yes ☐ No, Deviation No._____
Interlock and alarm test		
1. Over pressure of air compressor Simulate high pressure limit. Set over pressure limit value is _____bar.	1. Alarm blinker at the control panel of air compressor is activated. 2. The compressor stops operation when pressure reaches set point for over pressure limit. Simulated over pressure is_____ bar.	☐ Yes ☐ No, Deviation No._____
2. High dew point Simulate high dew point. Set high dew point limit value is _____°C.	Alarm blinker at the control panel of air dryer is activated. Simulated high dew point is_____°C.	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

Test Name:	OQ-02: Performance Test

Objective

Verify that the CDA system can produce CDA with designed pressure (≥ 6 bar) at point of use.

Procedure

1. Operates CDA system for 15 minutes without alarm or malfunction.
2. Use “CDA DISTRIBUTION SCHEMATIC” as test record, measure and record pressure at all point of use.
3. Attach the test record to the test report.

Required Document

1. CDA DISTRIBUTION SCHEMATIC

Required Measurement Instrument

1. Calibrated pressure gauge

Acceptance Criteria

Pressure of all points of use is in accordance with designed value (≥ 6 bar).

Test Result

Acceptance Criteria	Test result pass acceptance criteria (Yes/No)
Pressure of all points of use is in accordance with designed value (≥ 6 bar).	☐ Yes ☐ No, Deviation No._____

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

Comment

Summary

This test is ☐ Pass ☐ Fail, Deviation No._____

	Name	Signature	Date
Performed by			
Reviewed by			

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

6. TEST SUMMARY

Test No.	Test Name	Result (Pass/Fail)	Deviation	
			No.	Closed Date
OQ -01	Functional Test			
OQ -02	Performance Test			

Performed By: _____ Date: _____

Reviewed By: _____ Date: _____

PROTOCOL AND REPORT

Title: Operational Qualification of Compressed Dry Air System

7. DEVIATION LIST

Deviation No.		Priority	☐ Major ☐ Minor
Deviation to Test No.			

Description

Agreed Corrective Action

Responsible Person	
Expected Completion Date	

Remark

Completion by (Signature)		Date	
Approve Completion by (Signature)		Date	

NOTE: This sheet may be copied as necessary. Sheet _____of_____

Major = System/Equipment cannot be subjected to further testing before deviation is corrected.

Minor = System/Equipment can be subjected to further testing while deviation is corrected on site.