RAND WATER	STRATEGIC ASSET MANAGEMENT Q UALITY MANAGEMENT SYSTEM PROCEDURE	
TITLE: AUTOMATION DESIGN PROCEDURE		DOC. NO: DOAUTO 00001 Pr
SECTION: DESIGN AUTOMATION ENGINEERING	EFFECTIVE DATE: June 2021	REV. NO: 02
AUTHOR: AUTOMATION DESIGN TEAM Digitally signed by Prince Manana DN: cn=Prince Manana, o=Rand Water, ou=Project Planning, email=mmanan@randwater.co.za, c=ZA Date: 2021.07.06 10:49:30 +02'00' Consultant Automation Engineer	FORMAT APPROVAL: Nomthandazo Madikane Digitally signed by Nomthandazo Madikane DN: cn=Nomthandazo Madikane, o=Rand Water, ou, email=nmadikan@randwater.co.za, c=ZA Date: 2021.07.07 13:27:51 +02'00' Quality Management Officer	AUTHORISED BY: Chandisaita Tumbare Board Number 20933 Digitally signed by Chandisaita Tumbare Board Number 20933 DN: cn=Chandisaita Tumbare Board Number 20933, o=Project Planning Department, ou=Design Office, email=ctumbare@randwater.co.za, c=ZA Manager: Design Office

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1. PURPOSE

The purpose of this departmental procedure is to outline the automation design requirements for Rand Water. This document provides a step by step procedure for designing and implementation of an automation system for Rand Water; from planning, conceptual design, functional or detailed design to installation, testing and commissioning. This document shall provide a guideline throughout the design life of an automation asset.

2. SCOPE

This procedure shall be used for all automation projects executed by Rand Water. This document describes the stages in an automation design lifecycle as followed by Rand Water. This lifecycle shall be strictly adhered to by all Automation Designers.

3. APPLICABILITY

This procedure covers all of the Automation design requirements when undertaking the design of Automation designs within the Rand Water network.

4. REFERENCES

Document Title	Document No.	Location	Rev	Date
Standard Automation Kiosk	RA29317	Intranet	A	April 2019
Quality Assurance Form Full Design Pack	SAM D	T:\Design Office\01. Design Office Projects\Design Office Forms	01	January 2021
Scope of Work Recommendation	SAM DO 00001 T	T:\Design Office\01. Design Office Projects\Design Office Forms\Forms	01	August 2019
Design Review Comments Document	RW DOP 00001 F	Intranet	02	Sept 2016
Design review procedure multi discipline projects	SAM DO 00001 Pr	Intranet	00	July 2013

Design office procedure	SAM DO 00003 Pr	Intranet		
Design Procedure Flow Charts	SAM DOA 000020PF	Intranet	01	June 2021
Tagnaming Convention	RW AAM 00002	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	C	August 2015
Profibus Standard	RW AAM 04000	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	A	9 October 2012
PLC Standard Specification	RW AAM 05000	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	A	9 October 2012
Industrial Ethernet	RW AAM 07000	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	May 2015
Magnetic Flow Meter	RW-AES-02006	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	July 2015
Ultrasonic Clampon Flowmeter	RW-AES-02008	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	July 2015
Telemetry Standard Specification	RW-AES-04004	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	A	14 January 2013
SCADA	RW-AES-06000	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	A	7 February 2013
HMI Standard Specification	RW-AES-06004	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	10 December 2014
Conductivity Specification	RW AAM 01000	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	August 2015
pH Specification	RW AAM 01001	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	August 2015
Free Chlorine Specification	RW AAM 01002	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	August 2015

Turbidity Specification	RW AAM 01003	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	August 2015
Ammonia Specification	RW AAM 01005	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	August 2015
Total Chlorine Specification	RW AAM 01007	Y:\00 GM SAM (Read Only)\18 AAM\AAM Standards\Standards for Tender	B	August 2015
Automation Assets Disaster Recovery Plan	RW AAM 00001Pl	http://rvintranet.randwater.co.za/Rand%20Water%20Policies/Forms/AllItems.aspx?RootFolder=%2FRand%20Water%20Policies%2FStrategic%20Asset%20Management%2FAutomation	01	October 2016
Automation Software Licensing Standard	RW AAM 00001Std	http://rvintranet.randwater.co.za/Rand%20Water%20Policies/Forms/AllItems.aspx?RootFolder=%2FRand%20Water%20Policies%2FStrategic%20Asset%20Management%2FAutomation	01	October 2016
Fiber Optic Cable Standard	RW AAM 00001 Spec	http://rvintranet.randwater.co.za/Rand%20Water%20Policies/Forms/AllItems.aspx?RootFolder=%2FRand%20Water%20Policies%2FStrategic%20Asset%20Management%2FAutomation	02	March 2019
Automation Asset Management Standard	RW AAM 00003 Spec	http://rvintranet.randwater.co.za/Rand%20Water%20Policies/Forms/AllItems.aspx?RootFolder=%2FRand%20Water%20Policies%2FStrategic%20Asset%20Management%2FAutomation	02	November 2019
Temperature Measurement Standard	RW AAM 00006 Spec	http://rvintranet.randwater.co.za/Rand%20Water%20Policies/Forms/AllItems.aspx?RootFolder=%2FRand%20Water%20Policies%2FStrategic%20Asset%20Management%2FAutomation	01	November 2019

Pressure Measurement Standard	RW AAM 000017 Spec	http://rvintranet.randwater.co.za/Rand%20Water%20Policies/Forms/AllItems.aspx?RootFolder=%2FRand%20Water%20Policies%2FStrategic%20Asset%20Management%2FAutomation	01	June 2019

Table 1: Standard References

5. TERMS, DEFINITIONS & ABBREVIATIONS

AAM – Automation Asset Manager

CAE– Consultant Automation Engineer

BOQ – Bill of Quantities

DOM – Design Office Manager

FAT – Factory Acceptance Test

GA – General Arrangement

HMI – Human Machine Interface

P&ID – Piping and Instrumentation Diagram

PEE – Project Execution Engineer

PLC – Programmable Logic Controller

PPIR – Pre-Project Investigation Report

PM – Project Manager

SCADA – Supervisory Control And Data Acquisition

SOW – Scope of Work

TIC – Technical Information Center

6. RESPONSIBILITY AND AUTHORITY

The Automation Designer has the responsibility to ensure that this procedure is implemented and adhered to.

All relevant forms are attached in the reference. All relevant standard specifications can be found on the network path as identified in table 1 above.

Failure to have complied with this design procedure may/shall result in the responsible engineer causing delays in the project and acting in violation of Rand Water's policies and procedure.

7. PROCEDURE

7.1. Planning

7.1.1. A project requiring automation design input shall be issued to the DOM as part of a design request package. This package shall consist of the following:

7.1.1.1. A completed signed design request form

7.1.1.2. A signed PPIR OR a signed planning brief OR a signed strategic project initiation form

7.1.1.3. Allocation of budget from SAP to show that there is funds available on the project. If there is no budget, the DOM shall then inform the requesting PM that there is no budget on the project and no resources shall be assigned to the project.

7.1.2. The DOM shall then issue the design request package to the CAE.

7.1.3. If the project involves Automation discipline, the CAE shall first check if the project has budget for booking time.

7.1.4. If the project is an automation project only, then the CAE shall appoint an Automation Designer as the lead design engineer on the project.

7.1.5. If the project is multi discipline then the discipline with the biggest scope on the project shall be appointed as the lead design engineer on the project. The Automation Designer shall be appointed as the automation resource on the project.

7.1.6. The CAE shall also appoint a drawing office resource on the project.

7.1.7. After the CAE has finalized the allocation of the Automation Designer and the drawing office assistant for that particular project, the name of those representatives shall be communicated in writing to the DOM, the design lead (if automation is not the design lead) and the pm.

7.1.8. If the Automation Designer is the lead on the project the Automation Designer shall communicate with the PM to arrange a kick off meeting with all team members, author of the PPIR/Planning Brief/strategic project initiation form

invited in the kick-off meeting. The arranging of this meeting shall be done by the PM.

7.1.9. If the Automation Designer is not the lead on the project the engineer shall attend kick off meeting.

7.1.10. The Automation Designer shall engage site personal to investigate the extent of the existing plant or the requirements for the new plant.

7.1.11. After the kick off meeting the project lead discipline shall record milestones up until approval of SOW with defined deliverables and deadlines as per SAM DO 00001 T.

7.1.12. The Automation Designer shall communicate to the project lead discipline designer all the pre-requisite need for the automation design to be done.

7.1.13. The Automation Designer shall communicate in writing to the PM, and the CAE, in acknowledgement of the project program. These time lines shall be strictly adhered to and included on the SOW as per SAM DO 00001 T.

7.1.14. The Automation Designer shall then proceed from the planning phase to the conceptual design phase

7.2. Conceptual Design Phase

7.2.1. Once the planning phase is complete the Automation Designer shall develop a conceptual design.

7.2.2. The Automation Designer shall first conduct a site visit with the site automation engineer to verify the following as described in the PPIR/project brief:

7.2.2.1. Detailed scope

7.2.2.2. Project constraints

7.2.2.3. Existing operational constraints

7.2.2.4. Assumptions

7.2.2.5. Battery limits

7.2.3. If the Automation Designer cannot verify any item in the PPIR/project brief or if there are any changes to the PPIR as per request(s) from site, the Automation Designer shall notify the responsible asset automation engineer immediately

7.2.4. The responsible asset automation engineer shall first have to approve the changes/additions to the PPIR before these can be proposed to be approved as part of the project

7.2.5. The PM shall be informed of these change requests to the project.

7.2.6. If the changes are accepted the PM shall update and send out a revised program

7.2.7. If these changes are rejected by the PM the Automation Designer shall continue as per the PPIR/project brief and original program.

7.2.8. The Automation Designer shall then gather all existing drawings and documents from TIC and/or site. These shall be used as blueprints to facilitate as built drawing revisions and updates

7.2.9. The Automation Designer shall then produce a SOW as per SAM DO 00001 T.

7.2.10. The SOW document shall be produced within the agreed timelines as per minutes of design meetings.

7.2.11. In automation led projects, the Automation Designer shall discuss the contracting strategy including reasonable design milestones with stakeholders (the design team, PM and CAE) i.e. if the project shall be a functional design, detailed design or if consulting services shall be requested.

7.2.12. The CAE shall decide with reasons on the contracting strategy on automation led projects.

7.2.13. The DOM shall sign off the design strategy.

7.2.14. The Automation Designer shall proceed to functional design or detailed design once the SOW document and the design strategy has been signed off by all stakeholders.

7.3. Functional Design

7.3.1. An automation functional design is only to be issued for Design and Build contracts.

7.3.2. The designs shall proceed and interaction with other disciplines shall be according to Design Integration Matrix.

7.3.3. If the project is a multi-disciplinary project the Automation Designer shall request the following design documents from the respective disciplines:

7.3.3.1. Process:

7.3.3.1.1. P&ID

7.3.3.2. Mechanical

7.3.3.2.1. P&ID

7.3.3.2.2. Mechanical plant layout (Site layout drawing showing the location of equipment on the plant).

7.3.3.3. Electrical

7.3.3.3.1. Typical Electrical schematics (MV and 400V)

7.3.3.3.2. Typical 400V panel location drawing

7.3.3.4. Civil

7.3.3.4.1. Civil layout drawings (chambers, pipelines and building(s) internal and external)

7.3.3.4.2. Site layout drawing

7.3.3.5. Pipeline

7.3.3.5.1. Pipeline layout showing valve actuation and instrumentation

7.3.4. If the project is an automation project alone the Automation Designer shall produce the following design documents:

7.3.4.1. The network layout drawing

7.3.4.2. Typical PLC panel GA's

7.3.4.3. Typical Instrument junction box GA

7.3.4.4. Typical Network panel GA's

7.3.4.5. System specification as per Appendix A

7.3.4.6. Bill of quantities

7.3.5. The panel estimated GA dimensions shall be given to the architects and civil designers to update and make space provision in buildings and chambers.

7.3.6. The Automation Designer shall then send all automation drawings to the allocated drawing resource.

7.3.7. The Automation Designer and the drawing resource shall then agree on timelines for the delivery of the drawings in AutoCAD as per drawing office procedure.

7.3.8. Once the design pack is completed and signed off, the CAE shall sign the Full Design Pack form.

7.4. Detailed Design

7.4.1. An automation detailed design is only to be issued for Construction contracts.

7.4.2. The designs shall proceed and interaction with other disciplines shall be according to Design Integration Matrix.

7.4.3. If the project is a multi-disciplinary project the Automation Designer shall request the following design documents from the respective disciplines:

7.4.3.1. Process:

7.4.3.1.1. Detailed P&ID from the process design engineer for process plant projects

7.4.3.1.2. Process control philosophy

7.4.3.1.3. Equipment list (with normal/min/max process conditions)

7.4.3.1.4. Equipment/instrument location diagram from the process design engineer (Site layout drawing showing the location of instruments on the plant).

7.4.3.2. Mechanical

7.4.3.2.1. Detailed P&ID's from the mechanical design engineer for mechanical plant projects

7.4.3.2.2. Mechanical plant layout (Site layout drawing showing the location of equipment on the plant).

7.4.3.2.3. Operational/control philosophy

7.4.3.2.4. Equipment list (with normal/min/max process conditions)

7.4.3.3. Electrical

7.4.3.3.1. Detailed electrical schematics (MV and 400V)

7.4.3.3.2. 400V panel location drawing

7.4.3.3.3. Electrical cable route layout

7.4.3.3.4. Detailed SLD

7.4.3.4. Civil

7.4.3.4.1. Civil layout drawings (chambers, pipelines and building(s) internal and external)

7.4.3.4.2. Site layout drawing

7.4.3.5. Pipeline

7.4.3.5.1. Pipeline layout

7.4.3.5.2. Equipment list (with normal/min/max process conditions)

7.4.4. The Automation Designer shall then produce the following design documents from the respective design specific documents received:

7.4.4.1. Detailed network diagram

7.4.4.2. Detailed PLC panel GA's

7.4.4.3. Detailed instrument junction box GA's

7.4.4.4. Detailed I/O list

7.4.4.5. Detailed instrument list

7.4.4.6. Detailed cable block diagram

7.4.4.7. Detailed cable route layout

7.4.4.8. Detailed load calculations

7.4.4.9. Detailed trench details

7.4.4.10. System specification as per Appendix A

7.4.4.11. Bill of quantities

7.4.5. The detailed panel GA dimensions shall be given to the architects and civil designers to update and make space provision in buildings and chambers.

7.4.6. The Automation Designer shall then send all tender automation drawings to the allocated drawing resource.

7.4.7. The Automation Designer and the drawing resource shall then agree on timelines for the delivery of the drawings in AutoCAD as per drawing office procedure.

7.4.8. The Automation Designer shall then, while the drawings are being developed in AutoCAD, complete the automation project specification.

7.4.9. The Automation Designer shall after contract award develop the following detailed design documents:

7.4.9.1. PLC loop and wiring diagrams

7.4.9.2. FDS

7.4.9.3. Detailed cable schedule

7.4.10. The Automation Designer shall send these detailed design documents to the drawing resource to develop in AutoCAD.

7.4.11. The Automation Designer and the drawing resource shall agree on timelines for the delivery of these drawings and communicate these in writing to the lead discipline engineer as per drawing office procedure.

7.4.12. Once the design pack is completed and signed off, the CAE shall sign the Full Design Pack form.

7.5. Documentation Approval

7.5.1. The Automation Designer shall send all drawings in AutoCAD format and the project specifications to the CAE for approval.

7.5.2. The CAE shall have two (2) weeks to approve the documents

7.5.3. The Automation Designer shall then incorporate all comments by the CAE in the design documents and issue for draughting.

7.5.4. The reviewed drawings shall be issued to the lead discipline engineer for internal design review.

7.5.5. In automation led projects, the Automation Designer shall coordinate design packs by creating a shared folder in the server and communicating the link to the other disciplines to store their reviewed designs.

7.5.6. The Automation Designer shall liaise with the lead discipline engineer to arrange with the design office administration assistant for an internal design review.

7.5.7. In automation led projects, the Automation Designer shall arrange with the design office administration assistant for an internal design review.

7.5.8. In automation led projects, the Automation Designer shall record the minutes of the internal design review meeting and send to the design team for updates.

7.5.9. The Automation Designer shall then incorporate all comments from this review in the automation design documents and send for draughting as per drawing office procedure.

7.5.10. The Automation Designer shall liaise with the PM to arrange with site for an external design review.

7.5.11. In automation led projects, the Automation Designer shall record the minutes of the external design review meeting and send to the design team for updates.

7.5.12. The Automation Designer shall then incorporate all comments from this review in the automation design documents and send for draughting as per drawing office procedure.

7.5.13. Once the drawings have been finalized the Automation Designer shall submit the drawings to drawing office for microfilm printing and approval signatures by the Automation Designer and the Pr.Eng/Pr.Tech.Eng.

7.5.14. If automation is the lead discipline the Automation Designer shall send a soft copy of all discipline design documents (PDF format) once the full design package form has been signed by DOM to the Quantity Surveyor for costing.

7.5.15. If automation is the lead discipline, the designer shall develop a tender high level technical scope of work for the project.

7.5.16. If automation is not the lead discipline the Automation Designer shall send a copy of the automation design documents (PDF format) on a CD and a hard copy of all automation design documents together with a printed transmittal note to the lead design discipline engineer. The transmittal shall be signed by the Automation Designer and the lead design discipline engineer.

7.5.17. The BOQ shall also be on soft copy in its native format.

7.5.18. The Automation Designer shall send all signed drawings to drawing office for TIC to archive.

7.6. Consulting services

7.6.1. If the Automation Designer requires consulting services, the CAE and DOM shall approve the use of external consulting services for Automation designs.

7.6.2. The Automation designer shall produce a consultant brief.

7.6.3. The CAE shall consult with DOM for a list of available Automation Consulting Services.

7.6.4. The Automation Designer shall be responsible for checking and accepting consultant's system specifications and designs if they meet Rand Water's requirements according to SAM DO 00001 Pr and RW DOP 00001 F.

7.7. Checklist

7.7.1. In detailed design projects, the Automation Designer shall develop QCP checklist.

7.8. Technical Adjudication

7.8.1. The Automation Designer shall be expected to conduct an Automation Technical Adjudication if invited by Supply Chain.

7.8.2. If required by Supply Chain, the Automation Designer shall avail himself/herself to present Automation Technical Adjudication report to procurement committees.

7.9. Consultant Design Acceptance

7.9.1. The Automation Designer shall review and generally accept the detailed automation designs once submitted by the contractor/consultant.

7.9.2. The Contractor/Consultant shall submit via the PM signed detailed automation designs.

7.9.3. The Automation Designer shall check and comment on the contractor designs against issued tender designs to see if there are deviations or technical flaws in the designs.

7.9.4. If there are any valid changes/deviations in the design the Automation Designer shall request the contractor/consultant to send a motivation (including costs) in writing justifying the change/deviation.

7.9.5. If there was an omission in the system specification warranting a variation, the Automation Designer shall motivate in writing and submit to CAE for approval.

7.9.6. After all deviations and comments are addressed, the Automation Designer shall sign off the contractor/ consultant automation designs as “Generally Accepted.”

7.9.7. The Automation Designer shall populate the design review comments form RW DOP 00001 F and then send these designs back to the lead discipline engineer.

7.9.8. If Automation is the lead discipline, the Automation Designer shall consolidate all comments from the other disciplines, send to CAE and DOM for signature. One CAE and DOM have signed, issue the signed design review form to the PM.

7.9.9. Only now shall the contractor/ consultant be given permission to place orders on equipment. If there is any Automation equipment that needs to be ordered before all detailed designs are approved, written permission shall be

requested and issued by the contractor/consultant and Automation Designer respectively.

7.10. Random site inspection during installation

7.10.1. The Automation Designer shall be expected to conduct random site visits to inspect installation.

7.10.2. All issues from the site inspection shall be highlighted to the PEE during project progress meetings.

7.10.3. The project progress meetings shall consist of snag items pertaining to the quality of construction on site and areas of non-compliance to approved designs and propose solutions where necessary.

8. RECORD & DATA KEEPING

8.1.1. All approved designs shall be kept at TIC.

8.1.2. The Automation designer shall keep soft copies of designs in a server.

8.1.3. All transmittals shall also be kept in soft copy in the server.

9. DOCUMENT CHANGE HISTORY

Date	Previous revision number	New revision number	Description of each revision
June 2016	n/a	01	First Issue of Procedure
June 2021	**01**	**02**	**Revised**

10. APPENDIX

APPENDIX A: System Specification template

CONTENTS PAGE

1. SCOPE

Project and Automation specific Scope of Work

2. APPLICABLE DOCUMENTS AND REFERENCES

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the text of this specification and the documents cited herein, the text of this specification shall take precedence. Nothing in this specification supersedes applicable laws and regulations. Failure to list a cited document in section 2 does not mean that it is not included in this specification. Listing a document in section 2 without a citation elsewhere does not include the listed document in this specification.

2.1. APPLICABLE DOCUMENTS

These documents are contractually enforceable to the extent specifies herein.

2.1.1. The following drawings are applicable:

	Drawing no	Title
		The drawings listed here must be cited in section 3

2.1.2. The following specifications are applicable:

Code	Title	Date	Author	Rev
	The specifications listed here must be cited in section 3			

2.2. APPLICABLE REFERENCES

These documents are not contractually enforceable and are merely listed for convenience.

2.2.1. Reference documents

Code	Title	Date	Author	Rev

2.2.2. Reference drawings

	Drawing no	Title

3. REQUIREMENTS

3.1. Design pack

Describe the design package contents

3.2. Headings as per Systems Engineering Approach

Describe the performance requirements of the product.

4. VERIFICATION

Describe how each requirement in section 3 will be verified.

4.1. Requirements Verification Index

The following table shows the Requirement Verification Index:

Requriement Verification Index									
Verification Methods: 1. Inspection – visual and measurement inspection. 2. Demonstration – operate the item and observe its performance ithout the use of test equipment or instrumentation. 3. Analysis – use generally acceptable scientific and technical principles. 4. Test – use an instrument test to collect data while item is operated under certain conditions. 5. Similarity – use a similar item's prior verification and transfer verification status to present item.						Verification Events: A. Detailed physical design verification and validation B. FAT C. Commissioning			
Section 3	Verification Method					Verification			Section 4
	1	2	3	4	5	A	B	C	

5. PACKAGING

Describe Packaging requirements for transportation and delivery if any

6. NOTES

6.1. Definitions

The following abbreviations shall be applicable:

Term	Definition

6.2. General Requirements

Describe any general requirements that do not form part of a complete product but deal with a process to construct the product.

7. APPENDIXES

Any appendices to support the product and process.