

 Eskom	Standard	Group IT
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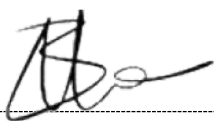
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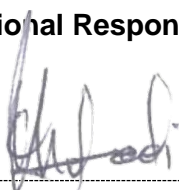
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1. Introduction

Group IT is responsible for providing IT systems and software to Eskom to support the automation of various business activities. As part of supplying these solutions, Group IT has the responsibility of ensuring that they perform as they have been designed, such that they satisfy business, functional and technical requirements. In order to deliver on this responsibility, Group IT has established the Testing Centre of Excellence (Testing CoE/TCoE). This centre shall provide governance to all testing artefacts, perform appropriate testing activities and provide guidance to the Vendors that will be carrying out testing activities, to ensure that quality is upheld on IT systems and software and that they perform as designed.

This document defines the standards for the testing of IT solutions within Group IT. This standard is aligned to industry best practices in relation to IT: ISO/IEC/IEEE 29119: Parts 2 and 3, under the general title *Software and systems engineering—Software testing*. However, tailored conformance to these standards will be adopted to fit into the Eskom's context.

ISO/IEC/IEEE 29119-2 Test processes, referred to as *Part 2*, specifies test processes that can be used to govern, manage and implement software testing for any organisation, project OR smaller testing activity. *ISO/IEC/IEEE 29119-3 Test documentation*, referred to as *Part 3*, specifies software test documentation templates, corresponding to *Part 2*, which can be used by any organisation, project OR smaller testing activity.

2. Supporting Clauses

2.1 Scope

This standard provides guidance on how to approach testing in Group IT in order to ensure the delivery of quality IT Systems to Eskom. This standard shall apply to Group IT employees, contractors and consultants who perform software testing on Eskom's IT systems.

2.1.1 Purpose

This standard has been defined to enable consistent testing practices throughout Eskom Group IT.

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2.1.2 Applicability

This document shall apply across Eskom Group IT. The standard shall be applied on testing of projects and maintenance efforts (*testing of new systems, systems upgrades, as well as enhancements OR changes to existing systems.*).

2.1.3 Effective date

This document shall be effective from the authorisation date and will remain in effect until the current revision is updated and authorised OR until the document is superseded.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] I32-85 Information Security Policy
- [2] ISO/IEC/IEEE 29119-2:2013 Software and systems engineering – Software testing – Part 2: Test processes
- [3] ISO/IEC/IEEE 29119-3:2013 Software and systems engineering – Software testing – Part 2: Test documentation
- [4] 240-150224605 Process Control Manual (PCM) for IT Agile Solution Planning and Execution
- [5] 240-131379039 Group IT TLCM
- [6] 240-76478986 Group IT PLCM
- [7] 240-98475355 Test Automation Framework Standard
- [8] 240-98476411 Test Automation Scripting Coding Standard

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2.2.2 Informative

- [1] ISO 9001 Quality Management Systems
- [2] ISO/IEC/IEEE 29119-1:2013
- [3] ISO/IEC/IEEE 24765 Systems and software engineering – Vocabulary
- [4] ISTQB Standard Glossary of Terms Used in Software Testing
- [5] Group IT Statement of Commitment to Quality

2.3 Definitions

Term	Definition
Best practice	A superior method OR innovative practice that contributes to the improved performance of an organization under a given context, usually recognized as "best" by other peer organizations.
Defect	A problem which, if not corrected, could cause an application/system to either fail or to produce incorrect results.
Dynamic Test Process	The Dynamic Test Processes are used to carry out dynamic testing within a phase of testing (e.g. unit, integration, system and acceptance) OR type of testing (e.g. performance testing, security testing, usability testing).
Hyperwave	Eskom document management system.
Organizational Test Specification	A document that provides information about testing for an organization, i.e. information that is not project-specific. E.g. This Testing Standard
Performance Testing	Non-Functional testing conducted to evaluate the compliance of a system or component with specified performance requirements.
Regression Testing	Retesting a previously tested program following modification, to detect faults that may have been introduced.
Requirements	Conditions or capability that must be met or possessed by a system, system component, product, or service to satisfy an agreement, standard, specification, or other formally imposed documents.

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Term	Definition
Sanity/Smoke Testing (also called IVT)	A brief test of major functional elements of a piece of software to determine if it's operational.
Standard	A document that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.
System Testing	Verification that when the components of the system come together to operate as a 'system', the results are in line with expectations. This Testing attempts to discover defects that are properties of the entire system rather than of its individual components.
TCoE governance	Rules put in place by the Testing CoE that need to be adhered to in respect of how Testing as a whole should be approached and managed within Eskom.
Test Automation	The use of software to perform OR support test activities, e.g., test management, test design, test execution and results checking.
Test Case	A set of test inputs, execution conditions, and expected results developed for a particular objective, such as to exercise a particular program path or to verify compliance with a specific requirement.
Test Environment	The hardware and software environment on which tests will be run.
Test Management Process	These generic test management processes may be applied at the project level (project test management), for test management at different testing phases (e.g. system test management, acceptance test management) and for managing various test types (e.g. performance test management, usability test management).
Test Plan	A document describing the scope, approach and resources needed to test a project which is not an entire system.
Test Requirement	An aspect of the test basis that is relevant in order to achieve specific test objectives
Test Scenario	A set of test cases or test scripts and the sequence in which they are to be executed.
Test Script	A mechanism used to create automated test artefacts.

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Term	Definition
Testing	The process consisting of all lifecycle activities, both static and dynamic, concerned with planning, preparation and evaluation of software products and related work products to determine that they satisfy specified requirements, to demonstrate that they are fit for purpose and to detect defects.
Testing CoE	Testing Centre of Excellence.
Testing Phase	A distinct set of test activities collected into a manageable phase of a project, e.g., the execution activities of a test level (Unit Test, System & Integration Test OR User Acceptance Test).
Traceability Matrix	A document showing the relationship between test requirements and test cases.

2.4 Abbreviations

Abbreviation	Explanation
ALM	Application Lifecycle Management
HPQC	Hewlett Packard Quality Center
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
ISTQB	International Software Testing Qualifications Board
IT	Information Technology
PLCM	Project Lifecycle Model
QA	Quality Assurance
QoT	Quality of Things
SIT	System and Integration Test

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Abbreviation	Explanation
TCoE	Testing Centre of Excellence
TLCM	Testing Lifecycle Model
UAT	User Acceptance Test
UFT	Unified Functional Tester

2.5 Roles and Responsibilities

The Project Managers must provide guidance assisted by this standard on project test teams that are working on Group IT Projects.

The Application Maintenance Managers must ensure that the test teams, that are not working on projects, who are implementing changes to Eskom applications, are guided by this standard when implementing such changes.

Project and Maintenance teams must consult Testing CoE for test governance and guidance.

2.6 Process for Monitoring

- The testing practices denoted in this Testing Standard will be monitored to determine whether it is being used effectively within Group IT.
- Testing CoE will perform reviews to verify compliance with the standard.
- Appropriate actions shall be taken to encourage alignment of stakeholders to the Test Standard.
- Development of supporting processes, templates and guidelines.
- Any variation to this standard must be discussed with the Testing CoE and where agreement on a variation is reached, the reasons for it and the alternative must be formally signed-off by senior management, as part of the exception management process.

2.7 Related/Supporting Documents

- [1] 240-105456577 Statement of Testing Work
- [2] 240-91265173 Test Plan
- [3] 240-52380954 Master System Test Plan
- [4] 240-62549874 Non-Functional Test Plan
- [5] 240-107087974 Test Requirements Sign-Off
- [6] 240-106652373 Test Cases Sign-Off

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[7] 240-52380958 Test Closure Report

[8] 240-107489772 User Acceptance Testing Sign Off Sheet

[9] 240-62548471 Non-Functional Test Closure Report

3. Testing Standard

Testing minimises the risks associated with poor quality IT systems being delivered to Eskom. This testing standard provides a strategic guideline on how to approach testing in Group IT. In order to ensure the delivery of quality systems to Eskom, all application system changes, developments OR acquisitions shall be subject to formal testing as per this document. Testing shall take place on a designated test environment, with an acceptable level of results as proof of testing.

This document presents the role of test governance on the organisational test specifications, with partial conformance to ISO/IEC/IEEE 29119 Parts 2 and 3. The role of testing as a risk management measure in the development and maintenance of IT software products is also defined. Guidance is provided on how to approach risk-based testing by means of selecting and prioritising tests. This should also guide how technical testing should be prioritised, and to ensure optimal usage of the testing tools. Test documentation and reporting for both project and maintenance testing are clearly outlined. Defect management process has been detailed to ensure clear and effective management of the defects across all the test phases.

3.1 Organisational Test Strategy Statements

3.1.1 Objectives of testing

The objectives of testing are to mitigate the quality risks on the IT systems that are released to the Eskom IT production environment by:

- Finding defects as early as possible in the development lifecycle, so that they are prevented from reaching the production environment.
- Evaluating quality in order to gain confidence in all IT systems.
- Ensuring that the IT systems released into the Eskom IT production environment are fit for purpose and meet the business requirements.
- Performing regression testing to ensure that changes introduced to existing code do not introduce new defects on existing IT systems in production.
- Providing information to the decision-makers on the quality of the IT systems during the development lifecycle.

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3.1.2 Tester ethics

Employees performing testing shall uphold the following ethics, adapted from ISTQB:

- Testers shall act in a manner that is in the best interests of Eskom, consistent with the public interest
- Testers shall ensure that the deliverables they provide (on the products and systems they test) meet the highest professional standards possible
- Testers shall maintain integrity and independence in their professional judgement
- Testing leaders shall subscribe to and promote an ethical approach to the management of testing
- Testers shall advance the integrity and reputation of the profession consistent with the public interest
- Testers shall be fair to and supportive of their colleagues, and promote cooperation with software developers

3.1.3 Generic risk management

Testing exists to mitigate production risks related to poor quality of software products, which can have a negative impact on Eskom. These product risks are mitigated by testing the product dynamically—by executing tests. These types of risks are detected and managed by the test team through the *defect management* process. If the *defects* are detected during testing, *defect management* must take place to ensure that the quality of the system is not compromised. However, during a testing effort, project risks—related to the actual product being tested, may also arise. These risks must be recorded so that they can also be managed. These types of risks are managed by the project manager (for projects) OR support manager (for maintenance/changes). Identifying and managing risks associated with the testing activities during a project OR maintenance of systems (products) is very important.

Risk management shall consist of the following main activities:

- Risk identification
- Risk assessment
- Risk mitigation

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Risks relative to software testing shall be recorded in the Test Plan for the initiative in question during *test planning* process. The risks shall continue to be recorded during *test monitoring and control* until *test closure* process. The risks shall be reported to stakeholders in the *testing status report* for risk management. Risks that are not managed shall be escalated in accordance with departmental reporting practices. All outstanding risks shall be recorded in the *test closure report* at part of test closure activities. Risk Management shall take place throughout the testing effort of the initiative in question.

3.1.4 Test Governance

Test governance shall ensure the creation, review and compliance to the Organisational Test Specifications, Test Management Processes as well as the Dynamic Test Processes in Group IT. A list of these artefacts is provided in the

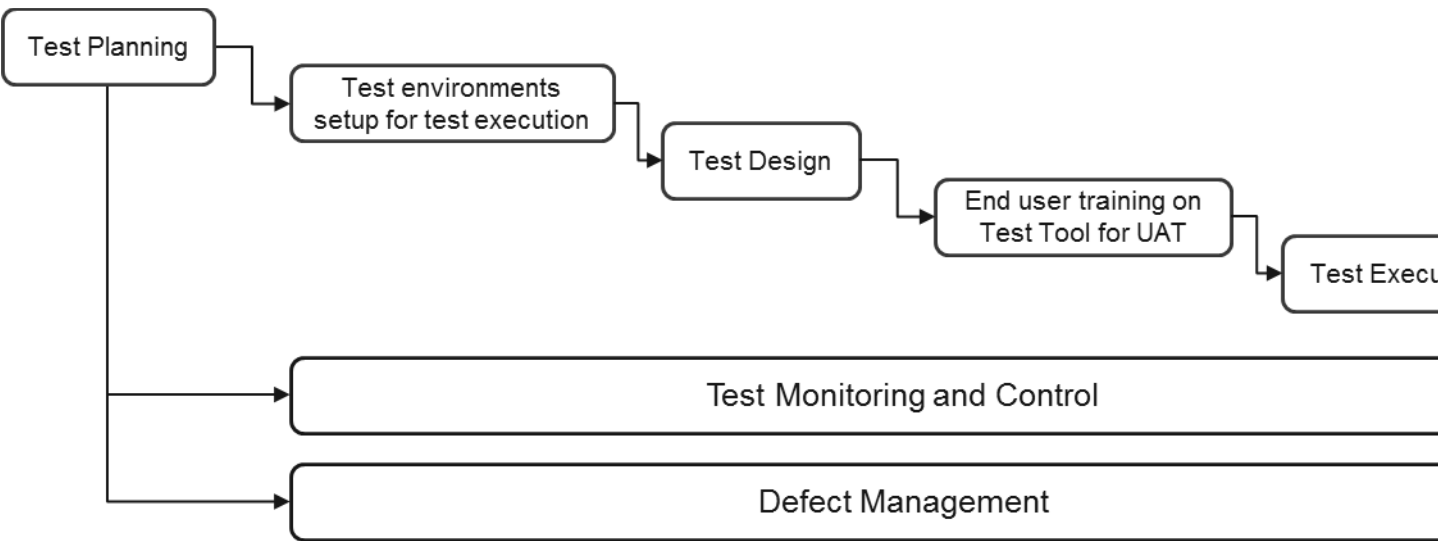


Figure 1: Test Process for Waterfall

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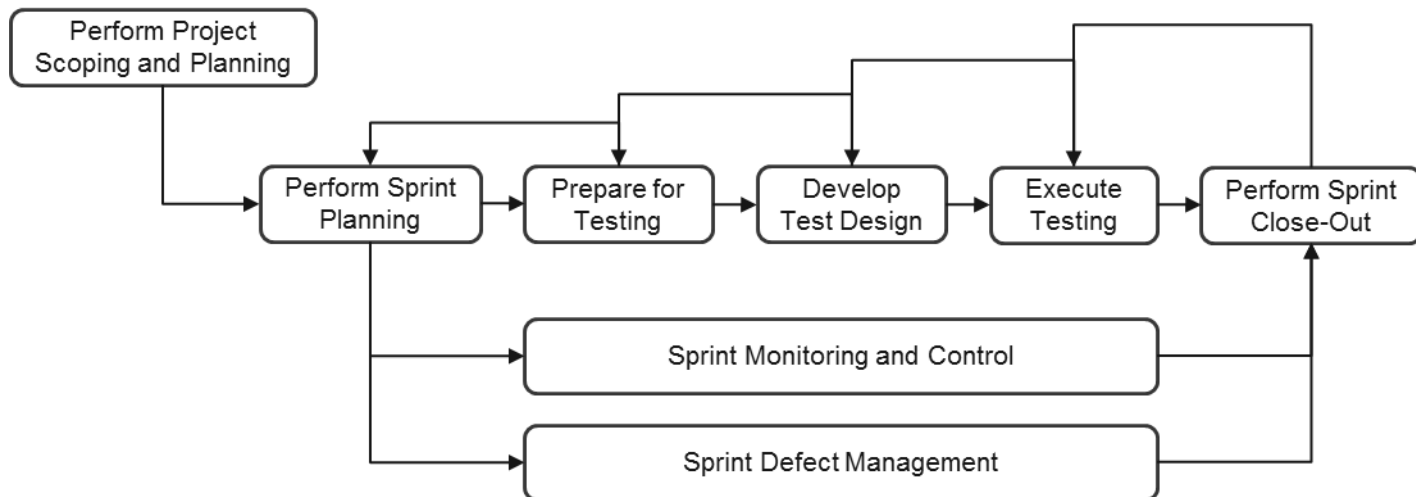


Figure 2: Test Process for Agile

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Test documentation and reporting section below. However, the following artefacts form the basis for minimum requirements for the various types of initiatives that shall be formally approved by the Testing CoE.

Requirement	Project (P)	Maintenance / Change (C)	Urgent / Emergency Change (E)
Statement of Testing Work	Y		
Master System Test Plan		Y	
Test Plan	Y		
Non-Functional Test Plan	Y	Y	
Test requirements captured in ALM	Y	Y	
Test cases captured in ALM	Y	Y	Y
Test cases linked to requirements in ALM	Y	Y	
Test Cases Sign-Off	Y		
Test cases executed in ALM and test proofs attached	Y	Y	Y
Defects logged and managed in ALM	Y	Y	Y
Test Closure Report (<i>for all test phases performed</i>)	Y	Y	Y

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Requirement	Project (P)	Maintenance / Change (C)	Urgent / Emergency Change (E)
User Acceptance Testing Sign Off Sheets (<i>where end users are involved</i>)	Y	Y	
Non-Functional Test Closure Report (<i>when non-functional testing is in-scope</i>)	Y	Y	Y

Table 1: Minimum requirements for Test Governance approval

3.1.4.1 Testing on Turnkey projects

Although testing is performed by Testing CoE on Group IT projects, there are instances whereby testing is performed by the turnkey vendors. These vendors must comply with Group IT testing processes and documentation requirements. In such cases, Testing CoE only provides governance and allocate an Eskom Test Manager to perform quality assurance.

The vendor must analyse project documentation, extract testing requirements, develop test cases and conduct testing to ensure that the solution is comprehensively evaluated for implementation in the Eskom environment. All testing milestones must be completed as stipulated.

The vendor must provide skilled independent test team. The testing staff may not be the same staff as the configuration, development and implementation staff assigned to the Project. The following testing milestones must be completed in designated environments. More details can be found in the *Test types and phases* section.

3.1.4.1.1 Approach 1: Eskom Testing CoE performs testing on Non-Turnkey projects and maintenance

- A Testing CoE Test team will be assigned.
- Eskom development team will be expected to conduct unit testing and provide results.
- End-to-end System Integration Testing (SIT) will be conducted by the Eskom Testing CoE team.
- SIT will be conducted within the Eskom infrastructure, in testing/QA environment.

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- Functional and Performance Testing will also be conducted by the Eskom Testing CoE team to verify both functional and non-functional requirements.
- All testing resources, activities and deliverables will be governed according to Eskom Policies and Standards as prescribed by the Eskom Testing CoE governance team.
- ALM (also referred to as HPQC) will be used for all test management and execution activities including defect management
- All Test Analysis (Test Requirements), Test Design (Test Cases and Test Scenarios), Test Execution and Defect Management must take place in ALM.
- All Performance Testing and Test Automation scripts must be executed in ALM.
- Test Automation Scripting Coding Standard must be used with a guideline from the Automation Framework Testing Standard.
- Test Automation Scripts must reside and be executed from ALM.
- All Performance testing scripts, scenarios and results must reside in ALM.
- Performance testing must be performed in Pre-Prod environment. If the Pre-Prod environment is not available, Non-Functional Testing may be performed in the testing/QA environment.
- User Acceptance Testing (UAT) will be conducted by the appropriate user community (business users) and the Eskom Testing CoE team will be responsible for facilitating UAT.
- UAT must be performed in Pre-Prod environment. If the Pre-Prod environment is not available, UAT may be performed in the testing/QA environment.
- Testing Status Report must be sent out to the stakeholders daily by the TCoE Test Manager.

3.1.4.1.2 Approach 2: Eskom Testing CoE performs testing on Turnkey projects

- The turnkey vendor will be expected to conduct unit testing and provide results to be uploaded in ALM.
- End-to-end System Integration Testing (SIT) will be conducted by the Eskom Testing CoE team.
- SIT will be conducted within the Eskom infrastructure.
- Functional and Performance Testing will also be conducted by the Eskom Testing CoE team to verify both functional and non-functional requirements.
- All testing resources, activities and deliverables will be governed according to Eskom Policies and Standards as prescribed by the Eskom Testing CoE governance team.
- ALM (also referred to as HPQC) will be used for all test management and execution activities including defect management
- User Acceptance Testing (UAT) will be conducted by the appropriate user community (business users) and the Eskom Testing CoE team will be responsible for facilitating UAT.

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3.1.4.1.3 Approach 3: Turnkey vendor performs testing

- The vendor must assign a test manager
- A Testing CoE Test Manager will be assigned to play a Testing QA role on the Turnkey project, in order to ensure Test Governance compliance.
- Unit testing must be performed in the development environment. Sign-off must be obtained from the development team before testing can commence in the testing/QA environment.
- All Test Analysis (Test Requirements), Test Design (Test Cases and Test Scenarios), Test Execution and Defect Management must take place in ALM.
- All Performance Testing and Test Automation scripts must be executed in ALM.
- Test Automation Scripting Coding Standard must be used with a guideline from the Automation Framework Testing Standard.
- Test Automation Scripts must reside and be executed from ALM.
- Test Automation scripts must be submitted to Testing CoE for review every time development is complete on a script (This is an iterative process).
- Performance test scripts must be submitted to Testing CoE for review every time development is complete on a script (This is an iterative process).
- All Performance testing scripts, scenarios and results must reside in ALM.
- Performance test scripts handover document must be completed and signed off before artefacts can be handed over.
- Test Automation Scripts sign off must be obtained before artefacts can be handed over.
- SIT must be performed in the testing/QA environment.
- Performance testing must be performed in Pre-Prod environment. If the Pre-Prod environment is not available, Non-Functional Testing may be performed in the testing/QA environment.
- UAT must be performed in Pre-Prod environment. If the Pre-Prod environment is not available, UAT may be performed in the testing/QA environment.
- User Acceptance Testing (UAT) will be conducted by the appropriate user community (business users) and the vendor test team will be responsible for facilitating UAT.
- Testing Status Report must be sent out to the stakeholders daily by the Vendor Test Manager. The Testing CoE Manager must be copied on the report.

3.1.4.1.4 Approach 4: Eskom Application teams perform testing on projects and maintenance

- All testing resources, activities and deliverables will be governed according to Eskom Policies and Standards as prescribed by the Eskom Testing CoE governance team.
- Eskom development team will be expected to conduct unit testing and provide results.
- End-to-end System Integration Testing (SIT) will be conducted by the Application team.
- SIT will be conducted within the Eskom infrastructure, in testing/QA environment.

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- Functional Testing will be conducted by the Eskom Application team to verify requirements.
- Performance Testing will be conducted by the Eskom Testing CoE team to verify non-functional requirements.
- ALM (also referred to as HPQC) will be used for all test management and execution activities including defect management
- All Test Analysis (Test Requirements), Test Design (Test Cases and Test Scenarios), Test Execution and Defect Management must take place in ALM.
- All Performance Testing and Test Automation scripts must be executed in ALM.
- Test Automation Scripting Coding Standard must be used with a guideline from the Automation Framework Testing Standard.
- Test Automation Scripts must reside and be executed from ALM
- All Performance testing scripts, scenarios and results must reside in ALM.
- Performance testing must be performed in Pre-Prod environment. If the Pre-Prod environment is not available, Non-Functional Testing may be performed in the testing/QA environment.
- User Acceptance Testing (UAT) will be conducted by the appropriate user community (business users) and the Eskom Application team will be responsible for facilitating UAT.
- UAT must be performed in Pre-Prod environment. If the Pre-Prod environment is not available, UAT may be performed in the testing/QA environment.
- Testing Status Report must be sent out to the stakeholders daily by the TCoE Test Manager.

The following artefacts form the basis for minimum requirements for the various testing of turnkey projects and shall be formally approved by the Testing CoE:

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Deliverable	Vendor Test Manager	Eskom Test Manager	Senior Advisor & Automation Performance	Senior Advisor Test Governance
Statement of Testing Work		Author		
Test Plan / Master Systems Test Plan	Author	Reviewer		Governance Review
Non-Functional Test Plan	Author	Informed	Reviewer	Governance Review
Test Requirements Sign-Off	Author	Reviewer		
Test Cases Sign-Off	Author	Reviewer		
Test Closure Report	Author	Reviewer		Governance Review
Test Automation Scripts Sign-Off	Author	Informed	Reviewer	
Performance Test Scripts Sign-Off	Author	Informed	Reviewer	
Non-Functional Test Closure Report	Author	Informed	Reviewer	Governance Review
User Acceptance Testing Sign Off Sheet	Author	Reviewer		Governance Review

Table 2: Minimum deliverables for turnkey projects**CONTROLLED DISCLOSURE**

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3.1.4.2 Test Governance Statements

Testing minimises the risks associated with poor quality IT systems delivered to Eskom. In order to ensure the delivery of quality systems to Eskom, all application system changes, developments OR acquisitions shall be subject to formal testing. Testing shall take place in a designated test environment, with an acceptable level of results as proof of testing.

- a) Testing shall start as early as possible in the development lifecycle;
- b) All IT systems shall be adequately tested before deployment into the production environments;
- c) Testing shall follow a risk-based approach to reduce the level of product risks in the IT systems;
- d) Testing shall not be replaced with debugging;
- e) Testing is integral to quality management in product development lifecycles;
- f) Testing is dynamic, continuous and responsive to context;
- g) Testing shall be communicated to relevant stakeholders in a timely manner;
- h) Testing processes shall be continuously reviewed to improve the effectiveness and efficiency of testing; and
- i) Testing shall be auditable.

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3.1.4.3 Entry and exit criteria for test types and phases

Statements	Unit Test	System & Integration Test	Performance Testing	User Acceptance Test
Entry criteria	<ul style="list-style-type: none">Functional Specifications related to requirement under test are frozen (must include use cases / user stories) – <i>Business Analyst</i>;Technical Design Document is complete, approved and released – <i>Solution Architect</i>;The System Design document is approved and released – <i>System Analyst</i>;The unit test plan must be approved – <i>Developer</i>.	<ul style="list-style-type: none">The test cases must have been reviewed and approved;Development and unit testing must be complete;Sanity testing must be successfully completed;The test environment available and stable; andThe test plan must be approved.	<ul style="list-style-type: none">Requirement Specifications (both functional and non-functional)Stakeholder register completed;The test environment available and stable;System & Integration Testing complete.	<ul style="list-style-type: none">All test cases for the System & Integration Test phase must have been executed;The test closure report for System & Integration Test must be approved, and proof of testing uploaded in ALM;There must be no critical OR high priority defects from System & Integration Test;Medium and low priority defects must be discussed with the users

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Statements	Unit Test	System & Integration Test	Performance Testing	User Acceptance Test
				prior to the commencement of UAT.
Exit criteria	<ul style="list-style-type: none">• Code reviews• 100% Statement coverage• 100% Branch coverage• 100% Condition coverage• X% path coverage, where x is a positive	<ul style="list-style-type: none">• All test cases executed• Zero critical and zero high priority defects outstanding• Risk/s associated with open defects should be assessed and accepted before moving to the next test phase	<ul style="list-style-type: none">• All test cases must have been executed;• There must be zero critical and high priority defects outstanding;• Risk/s associated with open defects should be assessed and accepted before moving to the next test phase; and• The test closure report must be approved by the stakeholders.	
Test completion criteria	<ul style="list-style-type: none">• The exit criteria must be met. Non-conformances must be reported in the test closure report and approved by the stakeholders.• There must be no open defects.			

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Statements	Unit Test	System & Integration Test	Performance Testing	User Acceptance Test
	<ul style="list-style-type: none">• All deferred defects must be communicated to the maintenance team, must be approved by the stakeholders. Reason for differing these defects must be reported in the test closure report• All test assets must be checked-in the test management tool and handed over to the maintenance team.• Lessons learned may be identified for future testing efforts.• The test closure reports must be approved.			
Degree of independence	<ul style="list-style-type: none">• The development team shall perform testing done in this test phase.• The developer who wrote the test should not do testing. This should not be confused with debugging which is performed by the developer of the code.	<ul style="list-style-type: none">• The test team shall perform testing in this phase, with no influence from the development team.	<ul style="list-style-type: none">• The business user representatives shall perform testing at this phase. Although the test team may assist, the decision on what shall be tested rest with the business users.	
Test environment	<ul style="list-style-type: none">• Unit testing shall take place in a dedicated development environment. This environment	<ul style="list-style-type: none">• Testing shall be conducted in a dedicated test environment. This environment shall be separate from the development environment.	<ul style="list-style-type: none">• Testing must be conducted in a dedicated pre-production environment. If such	

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Statements	Unit Test	System & Integration Test	Performance Testing	User Acceptance Test
	<p>shall be separate from the test environment.</p> <ul style="list-style-type: none"> The development team shall control deployments to this environment. 	<ul style="list-style-type: none"> The test team must control deployments to this environment. 		<p>environment does not exist, the test environment may be used. This environment shall be separate from the development environment.</p> <ul style="list-style-type: none"> The UAT team must control deployments to this environment.
Metrics to be collected	<ul style="list-style-type: none"> Test methods completion Test design completion Test coverage <ul style="list-style-type: none"> Code metrics results Maintainability index 	<ul style="list-style-type: none"> Requirements coverage Test design status Test data readiness report Test Competition Status 	<ul style="list-style-type: none"> Processor – CPU Utilization Memory – % Committed Bytes – Pages / Sec Hard Drive – Average Disk Queue 	<ul style="list-style-type: none"> Test design status Test data readiness report Test Competition Status Test execution status Test Execution Log

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Statements	Unit Test	System & Integration Test	Performance Testing	User Acceptance Test
	<ul style="list-style-type: none">○ Cyclomatic complexity○ Depth of inheritance○ Class coupling○ Line of code• Test execution status	<ul style="list-style-type: none">• Test execution status• Test Execution Log• Defect trend analysis	<ul style="list-style-type: none">Length – Disk Transfer Rate• Database – Number of Concurrent Connections – Number of Record Locks	<ul style="list-style-type: none">• Defect trend analysis
Retesting and regression testing	<ul style="list-style-type: none">• Retesting must take place after a defect has been fixed. This is to verify that the defect has been fixed. After a successful retest, the defect may be closed.• Regression testing must be performed to verify that a fixed defect OR the new introduction of changes has not impacted existing functionality that was working properly. However, this is more applicable to System & Integration Test and User Acceptance Test phases for functional and non-functional test types.			

Table 3: Test types and phases**CONTROLLED DISCLOSURE**

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3.1.4.4 Test asset archiving and reuse

Eskom experiences loss of test assets when these assets are left checked-out on the test management tool. Test teams must ensure that test requirements, test cases, test scripts and other test artefacts are checked in regularly. If work is done on the artefact and it does not get checked-in, all that work gets lost when the person working on it leaves the organisation. This has been a growing concern, especially on turnkey projects.

For that reason, all test requirements, test cases, test scripts and other test artefacts must be checked-in daily. No artefact should remain checked-out at the end of the week.

Test assets shall be stored in a central test management tool. These assets shall be reused as much as possible in order to avoid rework. The maintenance teams must reuse the test artefacts that were created during a project. Test data shall be stored in accordance with the Information Security policy. Test assets that are no longer in use shall be archived as per the Information Security policy.

3.1.4.5 Test Naming Conventions

Test artefacts that will be used, re-used and maintained need to be recognisable by specific name formats that will be easy to understand and logical to describe exactly what the artefact is about. The names must be unique, concise and as far as possible according to industry standard. The naming conventions specified below will be used for testing artefacts within Eskom:

Artefact	Description	Identifier
Defect report for a <i>change</i>	A report extracted from ALM indicating the details of any/all defects at a specific time of the change.	CDR_<System name>_<Change name>_.date
Guidelines	Guidelines provided as support to Testing and quality related topics.	Guide_<topic>.v#

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Artefact	Description	Identifier
Master System Test Plan (MSTP)	<p>The plan that describes the Testing of the system in its entirety.</p> <p>Any updates required to the MSTP will increase its version on project completion and reference to the TP's needs to be made in the MSTP.</p>	MSTP_<System name>.v#
Master system test plan checklist	Checks that the Master System Test Plan has been created according to standard.	MSTP_Cklst_<System Name>.v#
Non-functional test plan	To ensure that Non-functional Testing (including performance Testing) is completed in the manner described in the non-functional Testing standards.	NFTP_<Initiative Name >.v#
Non-functional test plan checklist	To ensure that Non-functional Testing (including performance Testing) is completed in the manner described in the non-functional Testing standards.	NFTP_Cklst_<Initiative Name>.v#

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Artefact	Description	Identifier
Performance Test Script	A set of instructions generally executed to determine how a system or sub-system performs in terms of responsiveness and stability under a particular workload	<Sequence Number> <System name>_<Sub-System/Module name>_<Test Script Name>
SoTW	Statement of Testing Work	SoTW_<Initiative Name>.v#
Test Automation Script	A set of instructions (written using a scripting/programming language) that is performed on a system under test to verify that the system performs as expected	<Sequence Number> <System name>_<Sub-System/Module name>_<Test Script Name>
Test case	<p>Test description containing specific steps to prove a function. If a sequence number is used to order test cases according to name, the number must precede the test case name.</p> <p>Where there are more than 9 test cases under a specific folder, the numbers up to 9 must be prefixed with zeros (0's).</p>	<p><Sequence number>. <TC name></p> <p>Example:</p> <p>01. Login..</p> <p>001. Update user details</p>

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Artefact	Description	Identifier
	Same applies to test cases exceeding 99, the numbers up to 99 must be prefixed with zeros (0's).	
Test Case sign-off template	Document that serves as sign-off from Business/Application SMEs for TCs created for a specific system/project.	TC_Signoff_<Initiative Name>.v#
Test closure report template for specific <i>Phase</i>	The test closure report for a specific phase.	TCR_<Initiative>_<Testing Phase>.v#
Test folder	<p>Folder Name in ALM. If a sequence number is used to order folders according to name, the number must precede the folder name.</p> <p>Where there are more than 9 folders in the folder structure, the numbers up to 9 must be prefixed with zeros (0's).</p> <p>Same applies to folders exceeding 99, the numbers up to 99 must be prefixed with zeros (0's).</p>	<p><Sequence number>. <Folder Name></p> <p>Examples:</p> <p>01. SAP MM</p> <p>01. Functional Testing</p> <p>02. Integration Testing</p> <p>02. SAP HR</p> <p>01. Functional Testing</p> <p>.....</p> <p>10. SAP PR</p> <p>001. SAP MM</p> <p>01. Functional Testing</p> <p>02. Integration Testing</p> <p>.....</p>

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Artefact	Description	Identifier
		100. SAP PR
Test plan checklist for a change or initiative	The TP_Cklist needs to be completed when a Test Plan Standards and Template for a Change / Initiative is developed as a result of a change to the MSTP.	TP_Cklist_<Initiative name>.v#
Test Plan Template for a change / initiative (TP).	The plan that describes the Testing of change/project on an existing system.	TP_<Initiative Name>.v#
Test Requirements sign-off template	Document that serves as sign-off from Business/Application SME's for requirements created for a specific system/project.	TR_Signoff_<Initiative Name>.v#

Table 4: Test Artefacts Naming Convention**3.1.5 Test selection and prioritisation**

Risk-based testing shall be used as a primary approach for test selection and prioritisation, and it shall be supported by other test approaches as per the industry best practices. It must be acknowledged that exhaustive testing is impossible. The test team shall conduct product quality risk analysis with the stakeholders. From these analyses, test requirements shall be prioritised, and the tests shall be selected. The selected tests shall be designed, implemented and executed according to how they have been prioritised. A traceability matrix must be able to show test coverage from the test requirements, down to test execution.

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3.1.6 Test Status Reporting

Test status reporting provides an overview of the progress against the Test Plan / Master System Test Plan. It must, at least, report the

- risks & issues;
- daily progress in terms of:
 - what tests have been executed;
 - how many were successful (Passed),
 - how many did not work as expected (Failed),
 - how many are still to be tested (No Run),
 - how many were marked as Not Applicable (N/A), and
 - how many could not be tested due to defects (Blocked);
- Defects report.

The test manager/lead is responsible for providing testing progress to all the stakeholders. The testing status report must be sent out throughout the testing phases, at least every week. However, it must be sent out daily during test execution.

3.1.7 Test types and phases

3.1.7.1 Unit Test

Testing that is performed by the developers on the individual components of the system. Unit testing must be completed in a development environment before the system can be handed over for System and Integration Testing.

3.1.7.2 System and Integration Test

Testing that is performed by testers on an integrated system to verify that it meets specified requirements, including the interfaces and the interactions between integrated systems. System and Integration Test must be completed in a testing environment before the system can be handed over for User Acceptance Testing.

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3.1.7.3 User Acceptance Test

Testing that is performed by future users of the system focusing on user requirements and needs. User Acceptance Testing must take place in a Pre-Production environment after System & Integration Testing and Performance Testing

3.1.7.4 Test Automation

Test Automation is a process used to convert manual tests into automated test through test automation tools. This is an initiative of creating, maintaining, testing, and operating those tools. Test automation can be achieved through a separate test automation project or as part of a testing initiative for producing automated regression testing capability. Refer to the 240-98475355 *Test Automation Framework Standard* and 240-98476411 *Test Automation Scripting Coding Standard* for more details.

3.1.7.4.1 Test Automation Project

Test Automation project refers to the development of the test automation framework and common libraries required to create test automation scripts effectively. Existing test cases must be used if they exist. If they do not, test cases must be written from scratch, after which test automation deliverables may be produced. These test automation deliverables are produced by test automation engineers as a standalone test automation project.

- Test Automation review report
- Test Automation framework
- Test Automation scripts

Future projects and the maintenance teams can use these deliverables for regression testing purposes.

3.1.7.4.2 Automated Regression Testing

Regression testing is an activity of testing parts of the system that were not modified to check if the modification made elsewhere on the system did not affect already tested and passed parts. For the automated regression testing to come to a halt the following condition must be satisfied.

- 100% execution of the regression pack
- Test report of analysed results

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- Test Automation scripts refresh to ensure that the suite is not stale.

3.1.7.5 Performance Testing

Performance testing is a non-functional test type that is used to determine the performance of a system. It involves the development of performance test scripts that emulate the behaviour of real users interacting with the systems, in form of virtual users—depending on the requirements for the system. Performance testing may be achieved as part of a project, during maintenance testing or a single performance test project on its own. Performance testing must take place before UAT.

3.1.7.6 Maintenance Testing (Changes)

Maintenance testing is a testing effort that takes place on an operational system due to the changes that are introduced to the system or the environment changes. When the system is delivered into the production environment, the test assets that are created during the projects are handed over to the maintenance team to be reused for maintenance testing. This will save a lot of time that would have been spent on re-creating the test assets. The maintenance test team must ensure that the test assets evolve with the software product as changes and updates are introduced. This will ensure efficient regression testing during the maintenance of the system.

3.1.8 Test process

The test process has been tailored to align with the ISO/IEC/IEEE 29119-2 Test Process standard. The testing process has been engrained in the PCM for IT Agile Solution Planning and Execution and the Testing Lifecycle Model (TLCM) (Waterfall), which can be found on Hyperwave. Figure 1: Test Process for Waterfall and Figure 2: Test Process for Agile below outline the test processes at a high level. The details can be found on the said documents.

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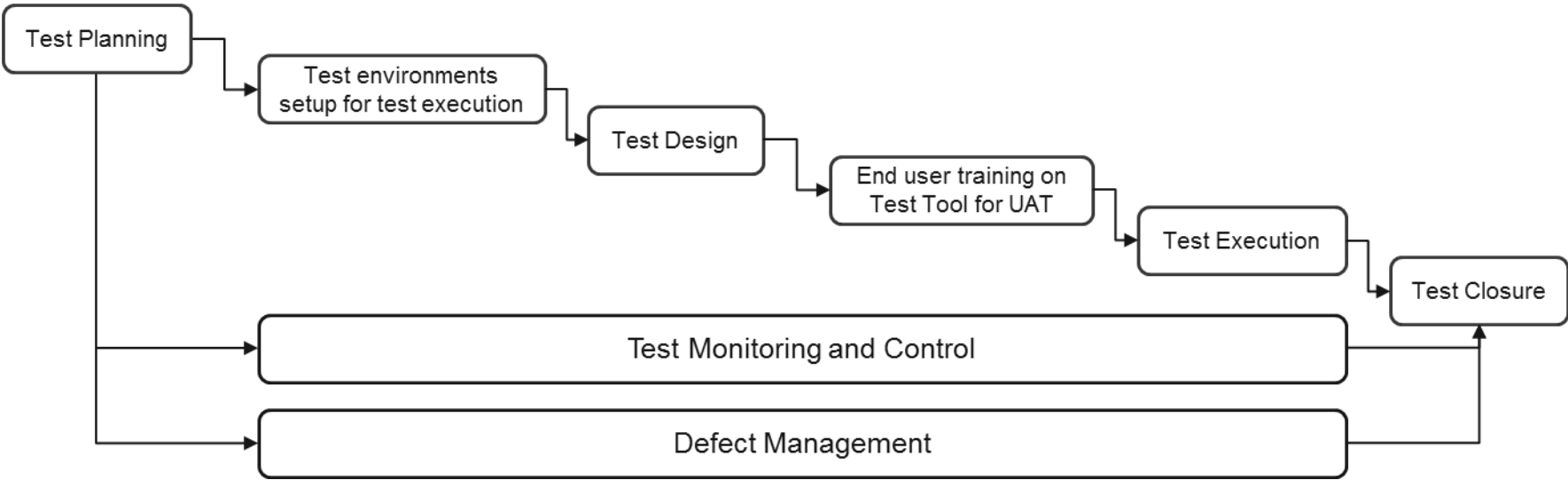


Figure 1: Test Process for Waterfall

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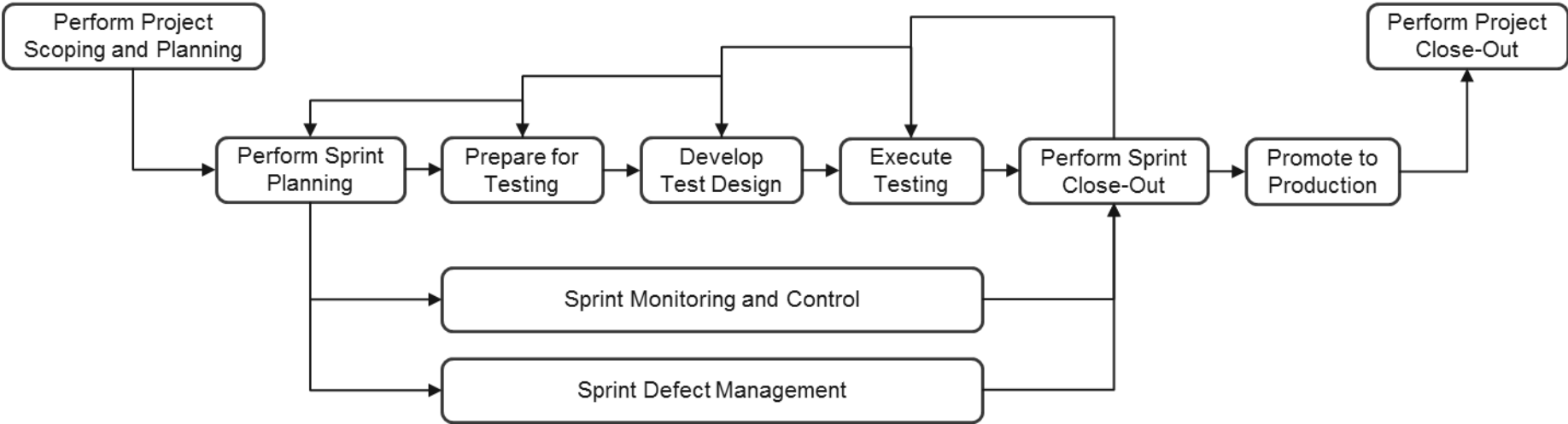


Figure 2: Test Process for Agile

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3.1.9 Test documentation and reporting

ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
Test Management Process	<i>Project Test Plan</i>	Test Plan (A new document for every new project)	Project	Unit Test	<ul style="list-style-type: none"> • Test Manager • Project/Programmer Manager • Business Representative • Application Support Representative • TCoE Manager • TCoE Governance • ICoE Governance • Solution Support Manager
				One for both System & Integration Test AND User Acceptance Test	
	<i>Sub-Process Test Plan</i>	Master System Test Plan	Maintenance/ Changes	Unit Test	Test Manager <ul style="list-style-type: none"> • Programme/ Project Manager • Business Representative
				One for both System & Integration Test AND	

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
		<i>(A Test Plan from the project mode is maintained throughout the lifetime of the system. When changes (maintenance) are introduced on the system, the document is updated to a new version for such maintenance.)</i>		User Acceptance Test	<ul style="list-style-type: none"> • Application Support Representative • TCoE Manager • TCoE Governance • ICoE Governance • Application Support Manager
		Non-Functional Test Plan <i>(A new document for every new project OR Change)</i>	Project	System & Integration Test	<ul style="list-style-type: none"> • Test Lead/Test Manager • Programme/Project Manager • TCoE Manager • TCoE Governance • ICoE Governance • Business Representative • Application Support Manager • Programme Manager • Solution Support Manager
			Maintenance/ Changes	System & Integration Test	

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
	<i>Test Status Report</i>	Testing Status Report (Email) <i>(The testing status report must be sent out to stakeholders to report progress. It must be sent out daily during test execution)</i>	Project	Unit Test	Not Applicable
				System & Integration Test	
				User Acceptance Test	
			Maintenance / Changes	Unit Test	
				System & Integration Test	
				User Acceptance Test	
	<i>Test Completion Report</i>	Test Closure Report	Project		<ul style="list-style-type: none"> • Test Manager • Programme/ Project Manager
				System & Integration Test	

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
				User Acceptance Test	<ul style="list-style-type: none"> • Business Representative • Application Support Representative • TCoE Manager • TCoE Governance • ICoE Governance • Application Support Manager • Application Support Manager
			Maintenance / Changes		
				System & Integration Test	
				User Acceptance Test	
		Non-Functional Test Closure Report	Project	System & Integration Test	<ul style="list-style-type: none"> • Test Manager • Project Manager • TCoE Manager • TCoE Governance • ICoE Governance • Business Representative • Application Support Manager • Performance Tester
			Maintenance / Changes	System & Integration Test	

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
Dynamic Test Process	<i>Test Design</i>	Test Requirements Sign-Off <i>(After a review of the Test Requirements in then ALM Requirements Module by the application SME / Business Representative)</i>	Project	System & Integration Test	<ul style="list-style-type: none"> • Test Lead / Test Manager • Programme / Project Manager • TCoE Manager • Business Representative / SME • Application Support Manager
				User Acceptance Test	Not Applicable
			Maintenance / Changes	System & Integration Test	Not Applicable
				User Acceptance Test	Not Applicable
	<i>Test Case</i>	ALM Test Plan Module	Project	System & Integration Test	

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
	<i>Test Automation Script</i> <i>Performance Test Script</i>			User Acceptance Test	Test Case sign-off document
			Maintenance / Changes	System & Integration Test	
				User Acceptance Test	
	<i>Test Procedure</i>	ALM Test Lab Module	Project	System & Integration Test	Not Applicable
			Maintenance / Changes		
	<i>Test Data Requirements</i>	Test Plan	Project	System & Integration Test	In the Test Plan
			Maintenance / Changes		
		Master System Test Plan	Project		

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
			Maintenance / Changes	System & Integration Test	In the Master System Test Plan
		Non-Functional Test Plan	Project	System & Integration Test	In the Non-Functional Test Plan
			Maintenance / Changes		
	<i>Test Environment Requirements</i>	Test Plan	Project	System & Integration Test	In the Test Plan
			Maintenance / Changes		
		Master System Test Plan	Project	System & Integration Test	In the Master System Test Plan
			Maintenance / Changes		
		Non-Functional Test Plan	Project	System & Integration Test	In the Non-Functional Test Plan
			Maintenance / Changes		

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
	<i>Test Data Readiness Report</i>	Test Data Readiness Report	Project	System & Integration Test	Test Manager/Lead
			Maintenance / Changes		
	<i>Test Environment Readiness Report</i>	Test Environment Readiness Report	Project	System & Integration Test	Test Manager/Lead
			Maintenance / Changes		
	<i>Actual Results</i>	ALM Test Lab Module	Project	System & Integration Test	Not Applicable
				User Acceptance Test	
			Maintenance / Changes	System & Integration Test	
				User Acceptance Test	

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
	<i>Test Results</i>	ALM Test Lab Module	Project	System & Integration Test	<i>Reported in Test Closure Report</i>
				User Acceptance Test	
			Maintenance / Changes	System & Integration Test	
				User Acceptance Test	
	<i>Test Execution Log</i>	<i>Reported as part of the Test Status Report</i>	Project	Unit Test	Not Applicable
				System & Integration Test	
				User Acceptance Test	
				Unit Test	

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ISO/IEC/IEEE 29119:2	ISO/IEC/IEEE 29119:3	Eskom Group IT	Initiative Type	Testing Phase	Approval Process
			Maintenance / Changes	System & Integration Test	
				User Acceptance Test	
	<i>Incident Report</i>	ALM Defect Module	Project	Unit Test	Not Applicable
				System & Integration Test	
				User Acceptance Test	
			Maintenance / Changes	Unit Test	
				System & Integration Test	
				User Acceptance Test	

Table 5: Test Documentation Mapping**CONTROLLED DISCLOSURE**

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In addition to the above, templates, guidelines, checklists and other supporting documents may be developed in order to guide and improve how testing is performed, in order to comply with this standard.

3.1.10 Technical testing and tools

3.1.10.1 Technical Testing

Test Automation and Performance Testing are the only technical test types that are currently in scope. These test types are detailed in the sections to follow.

3.1.10.2 Tools

Although Testing CoE recommends the following tools, the test teams must ensure that they have the required software licenses/agreements before using the tools.

3.1.10.2.1 Micro Focus Sprinter

Sprinter is a Micro Focus test tool that provides a suite of advanced features and tool that make manual testing more efficient and effective. Sprinter is fully integrated with ALM, enabling you to get the maximum benefit from both solutions.

3.1.10.2.2 Micro Focus ALM

ALM is a set of software tools developed and marketed by Micro Focus for application development and testing. It includes tools for requirements management, test planning and functional testing, performance testing (when used with LoadRunner), and defect management.

3.1.10.2.3 Micro Focus UFT

UFT is a Micro Focus test automation tool for GUI and API tests that provides test automation efficiency in cross-browser and multi-platform, optimised distributed testing on mobile devices, multiple machines and servers. It also provides automated reporting of defects in ALM.

3.1.10.2.4 Micro Focus LoadRunner

LoadRunner is a market-leading performance testing solution for project teams. It is used to test applications, measuring system behaviour and performance under load. LoadRunner can simulate thousands of users concurrently using application software, recording and later analysing the performance of key components of the application.

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3.1.10.2.5 Micro Focus StormRunner Load

Micro Focus StormRunner Load is a cloud-based solution hosted and supported in Micro Focus data centre facilities. It is available immediately and delivered via SaaS (Software as a Service) licensing.

3.1.10.2.6 Micro Focus Mobile Center

Micro Focus Mobile Center provides an end-to-end quality lab of real devices and emulators to help you build quality mobile applications. It creates and manages device groups and access permissions, schedule device reservations, get full control over a device, including system apps and remote restarts.

3.1.10.2.7 Micro Focus ALM QoT

Micro Focus ALM Quality of Things is a client execution tool that enables the client to run manual tests online or download to run offline. Offline executions can be uploaded later when clients are in a stable network vicinity. It also allows clients to run tests on their android and windows mobile devices.

3.1.10.2.8 SAP Solution Manager

SAP Solution Manager covers the complete application lifecycle of IT solutions running on-premise, hybrid or in the cloud. The modern and intelligent IT management platform empowers IT organization for the future of business.

3.1.10.2.9 SoapUI

SoapUI is the market leader in API Testing Tool. You can do functional, load, security and compliance tests on your API using SoapUI. SOAPUI Pro offers more advanced features compared to its free version SOAP UI.

3.1.10.2.10 Oracle SQL Developer

Oracle SQL Developer is a free, integrated development environment that simplifies the development and management of Oracle Database in both traditional and Cloud deployments. SQL Developer offers complete end-to-end development of your PL/SQL applications, a worksheet for running queries and scripts, a DBA console for managing the database, a reports interface, a complete data modelling solution, and a migration platform for moving your 3rd party databases to Oracle.

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3.1.10.2.11 Notepad ++

Notepad++ is a text editor and source code editor for use with Microsoft Windows. It supports tabbed editing, which allows working with multiple open files in a single window.

3.1.10.2.12 Appium

Appium is an open-source test automation framework for use with native, hybrid and mobile web apps. It drives iOS, Android, and Windows apps using the WebDriver protocol.

3.1.11 Configuration management of test work products

Configuration management should be managed by the solution support teams. The test teams will send requests for configuration management to the solution support teams.

3.1.12 Defect management

Defect management plays a pivotal role in the management of a testing effort. It enables the stakeholders to make informed decisions regarding the “health” of the software under test and any changes that might need to be made relative to the initiative. Defects can be detected at any stage of the software development lifecycle. Defects shall be logged and managed in the ALM tool.

All defects shall be logged and managed according to the following:

- When logging defects, it is very important that correct and sufficient information is captured;
- When a defect is logged as a result of a test step that failed or analysis of documentation, the defect needs to be linked to the relevant artefacts (test cases/requirements);
- Once a defect has been logged a specific notification process follows. The defect management tool must be configured to send emails automatically to specified people;
- Defect meetings must be held at least every week during testing. These are chaired by the project/programme manager and attended by impacted parties including the test manager and in certain cases a defect manager;
- The test manager/defect manager must constantly follow up on the progress of the resolution of the defects, in order to manage any impacts on test efforts.

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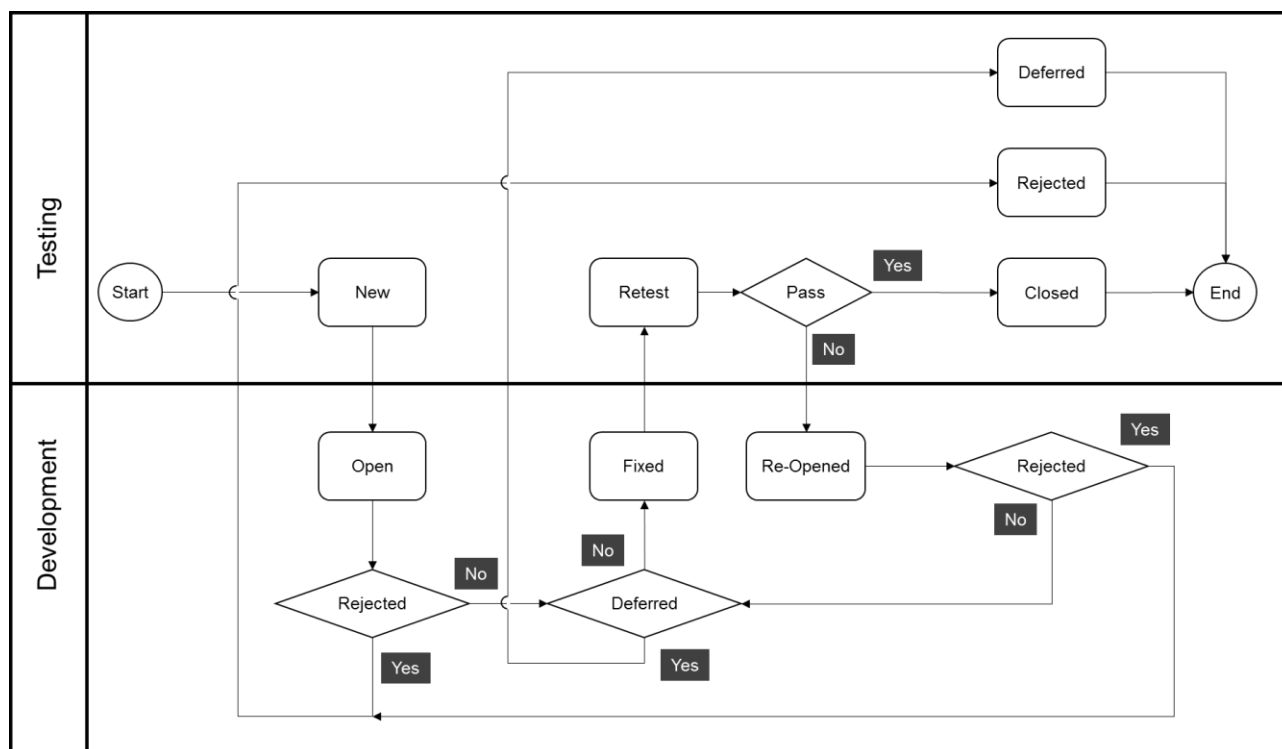


Figure 3: Defect Lifecycle

The defect lifecycle is shown in Figure 1 above. Only a defect that has never been closed may be re-opened (meaning a retest after a fixed was applied has failed). If a defect was previously closed, and it is reoccurring, a new defect must be logged and be linked with the one that has been closed. The defect status transitions are illustrated further in Figure 2 below.

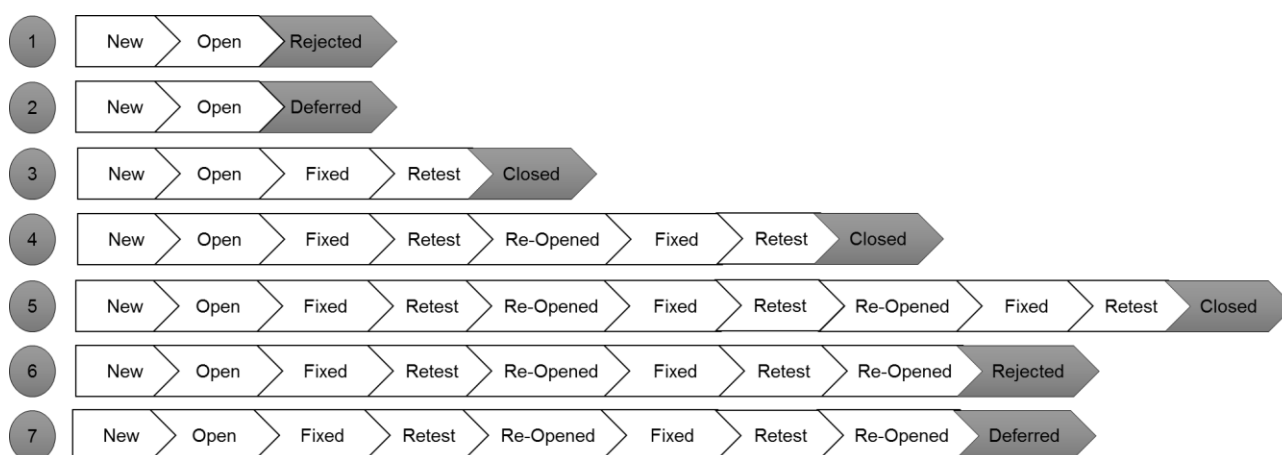


Figure 4: Defect Status Transitions

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4. Acceptance

This document has been seen and accepted by:

Name	Designation
Leigh-Anne Vermaak	Chief Advisor Integration
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5. Revisions

Date	Rev.	Compiler	Remarks
January 2015	1	Nomgcobo Majeke	The initial draft of the standard
November 2020	2	Lungelo Boilane	Alignment to ISO/IEC/IEEE 29119

6. Development Team

The following people were involved in the development of this document:

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