ORACLE

Qualification Management Process

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Overview

This document describes the SCO Products Operations product qualification planning and execution processes.

Audience

This document is for SCO personnel and design engineers who work with product qualifications and for external manufacturers (EM) who build, and in some cases, participate in the design of Oracle products. Other interested parties can include the SCO Quality Office, Reliability, Availability, Serviceability (RAS) Engineering, and other product groups.

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Introduction

Qualification testing is performed to reduce the risk of introducing a new platform, product, or component that does one or both of the following:

- Shuts down the manufacturing line due to low yield at production test
- Escapes the standard test processes and results in field failures

In this document, an operations qualification consists of all activities required to validate the following:

- An engineering-approved product change to an engineering released configuration

A product change is any change initiated by an approved vendor or engineering change order (ECO).

- An operations manufacturing process change

A manufacturing change is any change to the manufacturing method or location other than a test process change or product change, typically initiated by a product and process change notification (PPCN).

NOTE 1: **Test process changes are managed and tracked using the existing tool Bug Database, which is out of the scope of this document. Bug Database can be accessed** at https://bug.oraclecorp.com/**.**

The goals of an operations qualification are to verify the following:

- The manufacturing **process** handles the change correctly.
- The **product** performs within quality goals in the manufacturing process.

Refer to *SCO Site Execution: Qualification Execution Process*, 924-0315-xx (located in WebDocs), for a pictorial representation of this process.

Appendix B, Appendix B: Qualification Test Responsibility Matrix, on page 22, describes the high level deliverables in the qualification process and associates each deliverable with a document paragraph and the person or organization responsible for providing the deliverable.

1 Qualification Tracking Tool

All qualification documentation must be tracked or linked in a central repository that is accessible within Oracle. The preferred method to track qualifications is through CIRtool. Where the CIRtool is not in use, an alternative qualification tracking tool must exist that supports the qualification process outlined in this document and the high level features available in the CIRtool. The current qualification tracking tool can be found at https://cirtool.us.oracle.com/app.

All qualification activity is initiated when the appropriate product team accepts a submitted change initiation request (CIR). Operations qualifications can be initiated by a CIR. To be accepted, a CIR must include the following:

- Background information
- Reason for qualification
- Platforms affected
- Requested completion date

- AVL information

2 Qualification Planning

2.1 Evaluating the Qualification

Upon acceptance of a qualification in the CIRtool or other preferred method, the product engineer(s) assesses the impact of the proposed change to the product, the manufacturing processes, and the test processes to determine the level of qualification that is required.

The choice of a test process for a qualification depends on the kinds of defects you try to expose, and the kinds of risks you try to mitigate by running the qualification. Qualification types are defined as follows:

- Paper qualifications utilize supporting supplier documentation, test results form similar changes, or other Oracle platforms to qualify the change. These changes are typically documented through PPCN or CIR format. Mechanical changes in *Section 2.1.3, Category C Changes*, on page 5, are qualified using the first article inspection (FAI) process.
- Product verification test or process verification test (PVT) utilizes standard manufacturing tests to verify that the processes can support the change, and that test yields meet the required thresholds.
    - PVT is typically run on a small quantity of units to verify that the process can support the change.
    - PVT is typically based on the critical defect per million (DPM) sample calculator.
- Reliability qualification test (RQT) is a system-level reliability test designed to expose and prevent reliability disasters from propagating to the field.

The required qualification tests are based on an assessment of qualification risks due to the magnitude, significance, and complexity of the change to be qualified, as follows:

- Very low risk: Paper qualification
- Low or moderate risk: Standard production board or system tests (for example, PVT), X-option tests, if relevant
- High risk: PVT and RQT
- Very high risk: PVT, margining (for example, full configuration test, and RQT, highly accelerated life test [HALT] or highly accelerated stress screen [HASS] test, and so on)

Table A-1, Recommendations for Levels of Qualification, on page 20, lists examples of changes and the recommended level of qualification for each.

NOTE 2: These are the guidelines the qualification team must use to determine the testing required for the change.

- Qualification Category A represents significant changes to reliability, performance, or manufacturing yield, that is, form, fit, or function changes.
- Qualification Category B represents minor changes to high reliability or Oracle-common

items.

- Qualification Category C represents non-functional or cosmetic changes.

2.1.1 Category A Changes

Category A changes are qualified by a PVT followed by a mandatory RQT. RQT is a system-level reliability test designed to expose and prevent reliability disasters from propagating to the field. Very high risk component qualifications are where there are significant perceived risks to the end customer, not just to the manufacturing line. In those situations, design verification test (DVT), four corners test (FCT), accelerated stress, or RQT (or a combination of these) in addition to PVT, may be required. The sampling plan calculated for PVT is not appropriate for these extra tests.

RQT requirements and sizing is defined using the template in *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx, and is discussed further in *Section 6, RQT Procedure*, on page 10.

NOTE 3: A decision that RQT is not required must be based on the ability to assess the FRU reliability performance through alternative methods (other platform RQTs, field performance, vendor testing, and so on.)

2.1.2 Category B Changes

Category B changes are typically qualified by a PVT (as a minimum). A PVT utilizes standard manufacturing tests to verify that these processes can support the change, and that test yields meet the required thresholds. Minor changes in this category can warrant a paper qualification. More significant changes in this category can also demand FCT and/or RQT. The RQT requirement is up to the judgment of the RQT team based upon the customer or reliability risk of the product change.

For the background, discussion of methodology, and directions for this tool, refer to *SCO Products: Component Qualification Size Guidelines*, 923-3575-xx.

NOTE 4: The rationale and justification for determining the specified test process for a qualification must be documented in the qualification plan.

2.1.3 Category C Changes

Category C changes are low risk and typically only warrant paper qualifications. Paper qualifications utilize supporting supplier documentation or test results from similar changes to qualify the change. Paper qualifications do not require a qualification plan, and are typically documented directly in process alert (PA) or CIR format when internally initiated. When externally initiated, the changes are documented in the PPCN tool.

Mechanical changes in Category C are qualified using the FAI process as specified in *SCO Operations Engineering: Mechanical Part and Sub-Assembly Qualification and Approval Process*, 923-3402-xx.

2.1.3.1 Constrained Sample Quantities

Occasionally, material for PVT sample quantities or RQT is constrained by business conditions. In those cases, the product team can make a decision to limit the amount of qualification material to less than what is recommended by the statistical or RQT planning tools. The product engineer (PE) must record the situation, the decisions, the limitations, and the risks associated with the decision in the qualification plan.

2.1.3.2 DVT

DVT, performed by design engineering, is an important part of qualifying a high risk change, and is typically a gate for the start of operations qualification. DVT verifies electrical and mechanical product functionality and stability. While DVT is not an operations function, DVT results are often valuable in downstream test efforts. Teams performing DVTs are required to publish the results of the DVT to sustaining engineers who own the products after revenue release.

2.1.3.3 FCT

FCT involves carefully controlling electrical and environmental stress conditions to uncover weaknesses in the electrical design of the product. The stress conditions imposed must include variations in voltage and temperature which span the range that a product experiences over its life in a customer installation.

Varying the operating conditions along two axes (voltage and temperature) creates the concept of a two dimensional mathematical plane which describes the valid range of externally imposed conditions. The four extremes of high and low temperature and voltage give this test its name. Frequency testing refers to the modification of the core system clock frequencies above and below the nominal operating points. When combined with temperature and voltage spreads, this results in a very aggressive verification of the operational design margin.

2.1.3.4 Accelerated Life Test

Accelerated life testing can be warranted for components which fall into high risk categories, for example, high-density silicon chip components where either the chip itself or the PCB attach process is new.

HALT is used to stress the product beyond the specifications to determine the extreme operating and destruct limits. During HALT, the product is subject to progressive stress levels which include voltage, vibration, frequency, and temperature. The intent of this testing is to expose weak design points. Due to the destructive nature of HALT, the pass or fail criteria may not be clearly defined. Therefore, the team must define the pass or fail criteria, and identify corrective action to improve design margin.

HASS test is used to detect failures early, and reduce infant mortality. The operating limits for HASS test are based on the HALT results. HASS test can be used as an ongoing screen test during the sustaining phase of a product. The benefit of HASS test is to continuously monitor the product performance, which reduces field failures, increases out-of-the-box quality and reliability levels, and therefore customer satisfaction. Currently HALT and HASS test are done by the teams qualifying commodity parts and the teams supporting Tape products.

This presentation gives simple definitions for HALT and HASS testing, and also compares HALT and HASS tests with traditional DVT testing. It also gives some examples of HALT and HASS process test flows. More detailed information on HALT and HASS test can be found in the following book: *Halt,*

Hass, and Hasa Explained: Accelerated Reliability Techniques, by Harry W. McLean, ISBN number 0873894898.

2.2 Qualifying FRUs Common to Multiple Platforms

In some cases, a FRU to be qualified is used on multiple platforms. In that case, the PE must decide whether to perform a multiple platform qualification and, if so, which platforms to include in the qualification. It is desired that every platform using a new or modified FRU is utilized in the qualification. In a multiple platform qualification, the specific requirements for PVT sample quantities, RQT power on hours (POHs), and so on, are defined for each of the platforms such that the total qualification targets are met jointly by all the platforms in qualification. Alternatively the lead platform can conduct qualification with other platforms leveraging the results. This approach would be acceptable with agreement between the appropriate PEs and approved by the product team (P-Team) or the qualification team and finally Operations Director level sign off.

In defining the qualification plan for a multiple platform qualification, the PE must take into account how many FRUs are in each of the platforms and how the FRU is exercised or utilized on each platform. Higher weighting for sample quantities and POHs targets must be given to platforms with more stressful use of the FRU. Larger quantities of FRUs on certain platforms accumulate FRU RQT POHs faster than smaller quantity platforms.

2.2.1 Hard Disk Drive (HDD) Manufacturing Readiness Test

For HDD new product introductions (NPIs), a manufacturing readiness test (MRT) qualification process was established. MRT validates that HDDs are ready for volume integration into manufacturing environments by testing them on a representative mix of Oracle platforms. This reduces the need to conduct costly, time consuming, and disruptive platform-specific pilots. Any platform that needs to utilize a new HDD and which is beyond general availability (GA) (so platforms can be sourced through the rotational equipment management [REP] process) can be considered for inclusion in an MRT. Platforms which are not available at the time of an HDDs MRT (out of cycle) can not be included. It is then the responsibility of the platform team to qualify the HDD in their environment. There can still be a requirement to conduct a process verification or PA to verify that the test process can support the changes to the new HDD (or HDD firmware). For additional information on MRT, see: *SCO Supplier Management: Supplier Engagement for Qualification – Manufacturing Readiness Test (MRT) Process for Hard Disk Drives*, 924-0601-xx.

2.3 Generating the Qualification Plan

Product Engineering is responsible for defining specific Operations Engineering qualification requirements. These requirements are documented in the form of a qualification plan and must be archived in the CIR tool or other preferred qualification tracking method.

The responsible PE creates the qualification plan. The plan identifies the requirements for the qualification, including the following:

- Qualification tracking number (for example, the CIR number, the PA number, and so on)
- Qualification sample size or quantity requirements
- Test requirements:
- Standard production test (PVT)

- Voltage, temperature, or frequency margining
- Diagnostics or test software to be used
- Reliability testing
- Rationale and justification for determining the specified test process
- Pass or fail criteria
- Qualification material ship or hold criteria
- Qualification closure requirements
- Reporting frequency requirements

NOTE 5: Diagnostics used in reliability testing must be specific to the FRU under test. For example, ensure that the input or output (IO) subsystem is exercised fully when qualifying an IO subsystem FRU. The use of the CPU or memory targeted diagnostics are not efficient in that case.

NOTE 6: RQT sample sizes and qualification guidelines are calculated using the *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx.

NOTE 7: Interdependent parts can be qualified at the same time if specified in the qualification plan.

3 Qualification Execution

3.1 Scheduling Qualifications

The Operations Program Manager (PM) schedules qualifications to ensure that appropriate resources are available. This information is tracked during the P-Team meetings.

3.2 Reporting on Qualification

If required in the qualification plan, a qualification status report is issued periodically, usually by the PM during the qualification. The qualification status report must include the following:

- Qualification tracking number (for example, the CIR number, the PA number, and so on)
- EM tracking number (if different)
- Current work in progress (WIP) status
- Process yields
- Comments on issues or delays
- Cumulative defects or failures for the qualification

- Cumulative WIP status

Refer to *Appendix C, Appendix C: Sample* Operations Qualification Report, on page 23, for examples of a PVT report.

RQT reporting requirements are discussed further in *Section 6.9.4, Reporting*, on page 20.

NOTE 8: All qualification status reports must be published on a regular basis to the appropriate Oracle operations team alias, as specified in the qualification plan.

3.3 Failure Reporting

All failures experienced during a qualification test must be logged in a failure tracking tool, and the details must be communicated to the qualification team within one business day. It is vital to the qualification effort that the highest priority be given to determine whether the failure was due to the qualification material or not.

Status updates on FA and root cause corrective action (RCCA) efforts must be provided on an ongoing basis.

Secondary failure effects must not be overlooked. For example, a new fan itself may not fail in qualification, but any air flow reduction can expose thermally marginal parts to higher fail rates or its new vibration modes can cause failures in other FRUs.

For additional requirements on RQT fail reporting, refer to *Section 6.4, Tracking or Monitoring of Failure Analysis or RCCA of RQT Failures*, on page 14.

4 Qualification Completion

4.1 Submitting the Final Report

Once all qualification requirements are met, the PE must publish a final qualification report, along with their pass or fail recommendation, using *SCO Scalable Systems Group (SSG): Qualification Completion Report Template*, 913-3726-xx (located in WebDocs). The final report must include all requirements specified in the qualification plan, plan, must be archived in the CIR tool, and linked into the qualification tracking tool, according to *Section 1, Qualification Tracking Tool*, on page 3.

4.2 Dekitting, Reconfiguring, or Dispositioning the Qualification Units

If the PVT qualification material passed the standard test process, met the ship or hold criteria documented in the qualification plan, and was approved by PE, it is approved for shipment.

NOTE 9: All product must be labeled and tracked, as applicable, according to *SCO ESO: Reviewing ECOs*, 990-1015-xx.

If a qualification fails, the failed qualification material must be segregated to prevent accidental shipment to customers. The qualification systems can be dekited or reconfigured into revenue units and processed through the regular manufacturing processes to ensure the product quality prior to shipping. Any additional required functional tests and/or mechanical inspections are defined by Product Engineering.

Since RQT is a longer duration process, upon test completion, those systems or FRUs undergo a controlled vetting to ensure that there are no down revision parts or component FRUs subject to a purge. RQT systems complete a 100 % visual inspection prior to packing.

NOTE 10: The serial numbers and history of the UUTs in RQT must be entered into the 'POHs' sheet of the *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, **913-3572-xx.**

5 RQT Waiver or Deviation Requirements

If there are deviations or waivers to RQT policy, see *Section 6.5, RQT Waiver Process*, on page 14, for details of procedures involved.

6 RQT Procedure

RQT is a required test for all Oracle products prior to achieving revenue release (RR). RQT is specified, at a high level, by the *Oracle Systems Quality Office Reliability Qualification Testing Policy For Oracle Systems Hardware Products Revision 3.3* (*OSQO RQT Policy*). For details, refer to https://serverras.oraclecorp.com/RQT/RQT_Policy_3.3.html.

The *OSQO RQT Policy* document governs the high-level requirements for RQT across all Oracle products and establishes broad guidelines and procedures for how to implement those requirements, at a fairly general and high-level. Because these requirements are general, there can be situations where they are interpreted differently by different people. All scalable systems group (SSG) product teams and products are subject to this document and to *OSQO RQT Policy*.

The purpose of this document is to provide a single interpretation of *OSQO RQT Policy* requirements that bind on all SSG products. By eliminating the time spent resolving differences in interpretation of the broad requirements in *OSQO RQT Policy*, this document aims to increase the effort and energy applied to the actual implementation of RQT and to the resolution of problems found in RQT.

This document must be read in parallel with *OSQO RQT Policy*, and is structured to facilitate that process. Each section of this document is referenced to a specific portion or section of *OSQO RQT Policy*.

6.1 Definitions of Roles and Responsibilities in RQT

The *OSQO RQT Policy* uses several terms to describe responsible parties in RQT, but these terms do not map clearly to the people involved in RQT in SSG. For the definitions of the responsible parties and the details of their specific responsibilities refer to *Section 6.1.1*, *Responsible RQT Qualification Engineer*, on page, 10, *Section 6.1.2*, *Responsible RQT Qualification Team*, on page 11, and, *Section 6.1.3*, *Responsible RQT Product Team*, on page 11.

6.1.1 Responsible RQT Qualification Engineer

Refer to *OSQO RQT Policy*, *Section 5.0*, *Definition of Failures in Testing*, for specific information on the responsible RQT qualification engineer.

The responsible RQT qualification engineer for a RQT is typically the operations engineering new product engineer for new product introduction (NPI) RQT or the operations engineering product engineer (PE) for sustaining RQT.

In situations where there is no operations engineering new product engineer (NPE) or PE assigned to the product, any other member of the responsible RQT qualification team (see *Section 6.1.2*, *Responsible RQT Qualification Team,* on page 11) can act as the responsible RQT qualification engineer.

The responsible RQT qualification engineer is accountable for the following:

- Being an active member of the RQT qualification team
- Being the primary author of the RQT plan
- Monitoring and reporting the progress of the RQT
- Completing and archiving the qualification completion report

6.1.2 Responsible RQT Qualification Team

Refer to *OSQO RQT Policy*, *Section 5.3*, *Chargeable Failures*, for specific information concerning the responsible RQT qualification team.

The responsible RQT qualification team for an RQT is a team typically made up of three individuals, who are designated representatives from the following groups:

- Business unit (BU) engineering (design engineering for NPI RQT or continuation engineering for sustaining RQT)
- Operations engineering (new product engineer for NPI RQT or product engineer for sustaining RQT)
- Field service engineering

The actual members of the RQT qualification team for a particular RQT are named in the RQT plan.

The RQT qualification team is responsible for the following:

- Collaborating on and approving the RQT plan
- Determining whether failures are chargeable to RQT. The RQT qualification team must agree unanimously for a failure to be classified as non-chargeable; any single member can veto this decision and force a failure to be treated as chargeable. Chargeability decisions made by the RQT qualification team cannot be reversed by any other person or group.
- The purpose of this is to isolate the technical decisions about whether fails are chargeable from the business decisions about the customer impact of the fails and the cost to resolve them.
- As such, consulting with other members of the technical functional groups or escalation within the technical functions of the RQT qualification team are appropriate, when required to help bring resolution to complex issues.
- Driving the completion of FA and RCCA of all failures found in RQT

6.1.3 Responsible RQT Product Team

For specific product team information, refer to the following sections of the *OSQO RQT Policy*:

- *Section 2.0, Scope*
- *Section 2.1, Test Administration*
- *Section 5.4, Non-Chargeable Failures*

For the product team for an RQT refer to *SCO Chief Quality Office: Hardware Reliability Qualification Testing (RQT) Procedure*, 914-1746-xx.

The product team is responsible for the following:

- Determining what actions are required to respond to chargeable failures in RQT, based on the potential risk to the customer, the potential costs of failure mitigation, and the recommendations of the RQT qualification team
- The isolation of the technical decision makers, as discussed in *Section 6.1.2, Responsible RQT Qualification Team*, on page 11, places a constraint on the product team in that the product team is expected to accept the chargeable failure definitions from the RQT qualification team, and act on them as the product team sees fit. The product team is not expected to review or attempt to change the chargeability decisions made by the RQT qualification team.

6.2 Definition of RQT 'Pass' Criteria

As RQT is a FRU based test, each individual FRU that is required to pass RQT has a unique pass threshold, based on the FRU's mean time between failure (MTBF). FRUs that have smaller MTBFs often accumulate more hours than required to pass RQT, in order to allow FRUs with longer MTBFs to accumulate enough hours to achieve a pass.

There is a potential area of confusion that occurs in the situation, where an FRU with a low MTBF achieves enough hours to reach an RQT pass (with either 0 or 1 failures), and then experience more failures in the time between the pass and reaching the pass threshold for a longer-MTBF FRU.

The following guidelines govern how this situation is treated:

1. If a FRU meets its RQT pass criteria, it is considered as an 'RQT Pass' regardless of future failures.
    - This is a reiteration of both the letter and the intent of the *OSQO RQT Policy.*
    - The intent is to prevent holding low-MTBF FRUs to a higher standard of 'reliability disaster' than high-MTBF FRUs.
2. To ensure that any additional failures that occur after a FRU 'pass' threshold was achieved are considered, RQTs implement an additional pass or fail criteria which is based on overall system reliability performance. This is described in *Section 6.3, System-Level 'Pass' or 'Fail' Requirement*, below.

6.3 System-Level 'Pass' or 'Fail' Requirement

To ensure that all chargeable failures in RQT are considered in determining whether a product is suitable for Oracle's customers, and in order to ensure that a new product or configuration is not

likely to fail ongoing reliability testing (ORT) immediately after being released, RQTs include an additional system-level pass or fail requirement.

This methodology uses the standard ORT charting methods, known as PRST charts. ORT procedures are described in *SCO Quality: Ongoing Reliability Testing (ORT) Policy*, 914-1736-xx.

The intent of this requirement is to compare total system power-on-hours and failures with the expected system MTBF to provide information about whether the system under test is acceptable to Oracle's end customer.

6.3.1 Determining System MTBF for System Under RQT

System MTBF estimates for sustaining platforms are found in the MTBF Tool at (restricted site) https://serverras.oraclecorp.com/HTMLS/RASSUITE/rassuite.html.

System MTBF estimates for NPI platforms are found in the PPD. The estimated MTBF for each system or configuration on the RQT plan is entered into the appropriate fields in *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx.

If configuration-specific MTBF estimates are not available. As this is often the case in NPI, enter the system MTBF estimate from the PPD for all configurations. The monitoring template automatically plots the progress of RQT onto a PRST plot according to the MTBF data that is entered.

It is occasionally the case that multiple products are used to RQT a specific FRU which is common to both products. In this situation, each product's power-on-hours and failures must be plotted on a product-specific PRST chart. As noted above, if multiple configurations of the same product are used, the configuration-specific MTBF numbers (if available) must be entered into the RQT monitoring template.

6.3.2 PRST Methodology Summary

PRST methodology is discussed at great length in the ORT document noted above and in MIL-HDBK-781A. Refer to those documents for in-depth discussion of the methodology and its application in ORT.

The PRST parameters for the system-level pass or fail requirement are identical to those used in ORT and are as follows:

$$\square = \beta = 20\% \text{ (consumer and producer's risk)}$$

$$d = 2.0 \text{ (discrimination ratio)}$$

All chargeable failures in RQT are plotted on this PRST plot. Chargeability of failures is determined by the RQT qualification team, as described in *A&QP 8 RQT Policy*, *Section 5.2*. Failures that occur on a FRU after the FRU 'passed' its FRU pass threshold are plotted on the system PRST plot.

6.3.3 System Pass or Fail Criteria

A system is deemed to 'fail' the system pass or fail criteria if the PRST plot of failures and power-on-hours goes into the 'Reject' region at any time during the RQT, even if subsequent run-time brings the plot back into the 'Continue' or 'Accept' region by the end of the RQT. The logic behind this is due to the practice in ORT of considering the experiment a 'Failure' immediately at the point the PRST

plot passes into the 'Reject' region. In RQT, the test can continue to accumulate hours to evaluate specific FRUs, but having passed into the 'Reject' region at any point in the RQT constitutes a failure.

A system is deemed to 'pass' the system pass or fail criteria if the PRST plot of failures and power-on-hours does not ever go into the 'Reject' region during the RQT.

NOTE 11: It is not required that the PRST plot go into the 'Accept' region to achieve an RQT pass, only that it does not enter the 'Reject' region.

NOTE 12: It is possible for a system to fail this system-level requirement even if all of the FRUs in the system pass their FRU requirements. Each FRU is allowed to pass with one chargeable failure, but if each FRU in the system incurs one chargeable failure, the system almost certainly incurs more failures than the PRST methodology allows. In this situation, the RQT is deemed to 'fail', and RQT must be re-run and passed or an RQT waiver must be granted to allow the new system or configuration to ship.

6.4 Tracking or Monitoring of Failure Analysis or RCCA of RQT Failures

For all RQTs, the following actions must be taken for all RQT failures:

1. Collect all pertinent logs.
2. Log all RQT failures into the corrective and preventative action system (CPAS). Refer to *SCO Quality: Corrective and Preventive Action Process*, 923-3644-xx.
3. Input the detailed fail data into the 'Fails' sheet of the *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx.
4. The RQT qualification team must take the following actions:
    - Review failure information to determine if the failure is chargeable.
    - If the failure is chargeable and is believed to be a design-related issue, raise a bug in Oracle's software bug tracking system (BugDB).
    - Make recommendation whether to restart or stop testing on the UUT.
5. All RQT failures must undergo RCCA investigation.
6. RCCA on all RQT failures must be completed to the unanimous satisfaction of the RQT qualification team before PLC Phase 5 Exit (Revenue Release).

6.5 RQT Waiver Process

The waiver process can be found in *OSQO RQT Policy, Section 3.1*.

6.6 Timing of RQT and Material to be Tested in RQT

The purpose of RQT is to test customer-shippable material, in order to ensure that the test reflects as accurately as possible the reliability performance of the system once delivered to the end customer. RQT also serves to qualify and validate the reliability of the product design before it is considered ready for production.

In order to satisfy this apparent paradox, where RQT must represent customer-shippable material but must be performed before the product is considered production ready, the following requirements dictate the timing and material revision level for RQT:

- RQT must be completed prior to PLC Phase 4 Exit and prior to system level Engineering Release. This allows any identified problems and subsequent required product changes to be resolved and qualified prior to the product reaches engineering release.
- The material in RQT must be revision 50 equivalent. This is intended to prevent early pilot build material, which can differ significantly from the final customer-delivered hardware and software, from being included in the RQT population.

In practice, this dictates running RQT with material built during Phase 1. last, which allows for the latest revisions of material prior to engineering release to be tested in RQT.

After RQT was passed, the product must be treated from an RQT perspective as if it is a sustaining product. This dictates that if a product change is made after RQT was passed, that product change must be treated as if it is a post-RR product change and is therefore subject to the rules and requirements for running RQT as a part of a sustaining qualification for certain types of product changes. Those rules and requirements are described in *Section 6.2, Definition of RQT 'Pass' Criteria*, on page 12.

6.7 Minimum Run Time in RQT

Run time for RQT is often a very difficult decision because it has a direct impact on the program schedule. The *RQT Policy* mentions a '1-to-2 month time period' in the bullet c of *Section 4.3, Determining RAS Critical FRUs to be Assessed Within a Particular System RQT*, but does not get more specific.

Fundamentally, there is a paradox in the RQT methodology that makes this decision more difficult. The methodology around which the RQT pass or fail criteria is based assume that failures arrive according to a random process with a constant probability of failure at any point in time.

It is important that RQT is run in a manner to limit the impact of the constant failure rate assumption, which is accomplished by ensuring that systems are run for a long period of time, such that the likelihood that infant failure modes are fully exhausted in the early portion of RQT is high. This translates to running systems for at least three weeks.

Therefore, any system in RQT must run for a minimum of three weeks (21 days) in order for the hours accumulated to be counted towards the RQT pass or fail criteria.

6.8 Determining which FRUs are Required to 'Pass' an RQT

One of the key features of an NPI RQT is that any FRU can 'fail' RQT by exhibiting a 'reliability disaster', but only certain FRUs are required to 'pass' RQT. Determining which FRUs are required to pass RQT is inherently a platform-specific decision, as each new platform has unique FRU makeup, test or prototyping budgets, and time.

There are two main considerations for making this decision, whether:

1. The FRU reliability is able to be observed and assessed through alternate means.
2. The FRU MTBF can be 'passed' in RQT given the typical budget and time constraints.

These are discussed in *RQT Policy*, *Section 4.3*. The requirements for how to make these decisions are explained in *Section 6.8.1, FRUs Not Required to Pass RQT Based on Alternative Data,* on page 16, and *Section 6.8.2*, *FRUs Not Required to Pass RQT Based on FRU MTBF,* on page 16.

Figure 6-1, RQT Planning Flowchart, on page 19, shows how these requirements must be implemented in conjunction with the requirements in *Section 6.3*, *System-Level 'Pass' or 'Fail' Requirement*, on page 12.

6.8.1 FRUs Not Required to Pass RQT Based on Alternative Data

OSQO RQT Policy, *Section 4.3a*, indicates that an FRU does not need to pass RQT if it is already shipped as a part of another product or configuration, because 'the actual field reliability performance of that FRU can already be assessed (in theory) in that currently shipping configuration'.

Below are several constraints and requirements that govern how this section is implemented:

- The RQT qualification team is responsible for determining whether a FRU needs to pass RQT, based on the ability to assess the FRU reliability performance through alternative methods (other platform RQTs, field performance, vendor testing, and so on).
- If the alternative method is based on observed field performance, it is required that a minimum of a quarter (three months) of shipment history must be available and reviewed, and no open CPAS logged against the FRU in the shipping platform be found.
- The RQT qualification team must agree unanimously for a FRU to be excluded from RQT.
- The RQT qualification team must document the evidence of data gathered and analysis performed to make the decision to exclude the FRU, and clearly show that the data justifies the conclusion that the FRUs reliability performance is acceptable for their application.
- This evidence of 'due diligence' to exclude a FRU must be recorded in the RQT plan.

This is intended to ensure that proper diligence is applied to gather performance data from the alternate reliability demonstration (field data, vendor testing, and so on) and that the RQT qualification team affirmatively designates the performance of the FRU in the alternate reliability demonstration as acceptable the the platform undergoing RQT.

A short verification reliability test or 'Mini-RQT' is suggested, where the risk of completely excluding the FRU from a reliability test seems to be high, but running a full RQT is either prohibitive or thought to be excessive. A 'Mini-RQT' is where the RQT procedure is followed except for the fact that only three days to one week run time for each system on test is accumulated rather than the three week minimum required for a full RQT.

6.8.2 FRUs Not Required to Pass RQT Based on FRU MTBF

FRU MTBF is an important consideration for determining which FRUs are required to pass RQT. *OSQO RQT Policy*, *Section 4.3c*, suggests that the method for determining which FRUs are required to pass RQT is to include those FRUs that can accumulate sufficient power-on-hours to achieve a pass through an RQT plan including a 'reasonable' number of units tested over a one to two month time period."

In order to bring some consistency to the way this decision is made across all SSG platforms, a set of guidelines was established that set some boundaries around the engineering judgments to be made at the platform level. These guidelines are based on FRU MTBF, with allowance for the judgment of the RQT qualification team in writing their RQT plan.

The guidelines are as follows:

- It is expected that any FRU, with MTBF of 200,000 hours or less, can pass RQT. For reference, this equates to approximately 115 FRUs running for three weeks, with a reliability, availability, serviceability (RAS) criticality of 1.
- Due to logistical considerations, it is not expected that any FRU with MTBF greater than 1,000,000 hours, either individually or by sharing results, reach the RQT defined POH target.
- For any FRU with MTBF between 200,000 hours and 1,000,000 hours, the RQT qualification team must determine whether to require an RQT pass. The RQT qualification team is expected to exercise engineering judgment based on the criticality of the FRU.
- For any FRU the RQT qualification team determines is not required to pass RQT based on its MTBF (any FRU with MTBF > 1,000,000 hours and non-critical FRUs with MTBF > 200,000 hours as determined above), the FRU must be included in the RQT plan and RQT configurations in sufficient number to accumulate the power-on-hours required for a 200,000 hour MTBF FRU. (This equates to 43,800 hours based on zero fails, or 57,800 hours based on one fail.) The intent here is to ensure that any FRU that is not required to pass RQT is required to accumulate enough hours to verify that it is unlikely to fail RQT.

Figure 6-1, RQT Planning Flowchart, on page 19, shows how these requirements must be implemented.

6.8.3 Commodity FRUs from Different Suppliers

If there are FRUs in the system in RQT which are produced by different vendors, their POHs must be tracked separately and each sub-population must reach the FRU RQT goal independently. For example, if we want to RQT a DIMM made by two suppliers, their POHs cannot be added together to reach the target POH. Each supplier's FRU must be listed separately on the FRU sheet of the RQT-PMRT and the quantities of each FRU, in each system's configuration, must be listed in the configuration sheet of the PMRT.

6.8.4 Substituting Alternate Reliability Test Methods for RQT

In some cases, a qualification team may want to consider HALT and/or HASS testing, or other reliability demonstration testing to verify that a product meets its reliability specifications. The following requirements must be met in order for HALT, HASS, or other reliability demonstration testing to act as a substitute for RQT.

1. The responsible RQT qualification team is required to obtain and review detailed data and records from the vendor testing, including but not limited to:
    - Systems tested, both number of and configurations
    - Power on hours accumulated

- Test environment, including diagnostics or exercisers used, any acceleration or stress factors, and so on
- Failures observed, including records of any subsequent debug, FA, or RCCA activity
- Verification of effectiveness of corrective actions implemented for fails during reliability demonstration

2. The responsible RQT qualification team is required to document the detailed data reviewed (according to the above) and their unanimous agreement that the vendor-provided reliability demonstration is sufficient to ensure that the product meets its reliability specification. This documentation is required to be placed into the qualification plan.
3. The responsible RQT qualification engineer (typically the operations engineering NPE) is accountable for ensuring that the data listed above is available, is reviewed diligently, and that the decision to accept the data in lieu of performing RQT is fully documented in the qualification plan.
4. The use of HALT or HASS testing in addition to, or in conjunction with, RQT must be documented in the qualification plan.

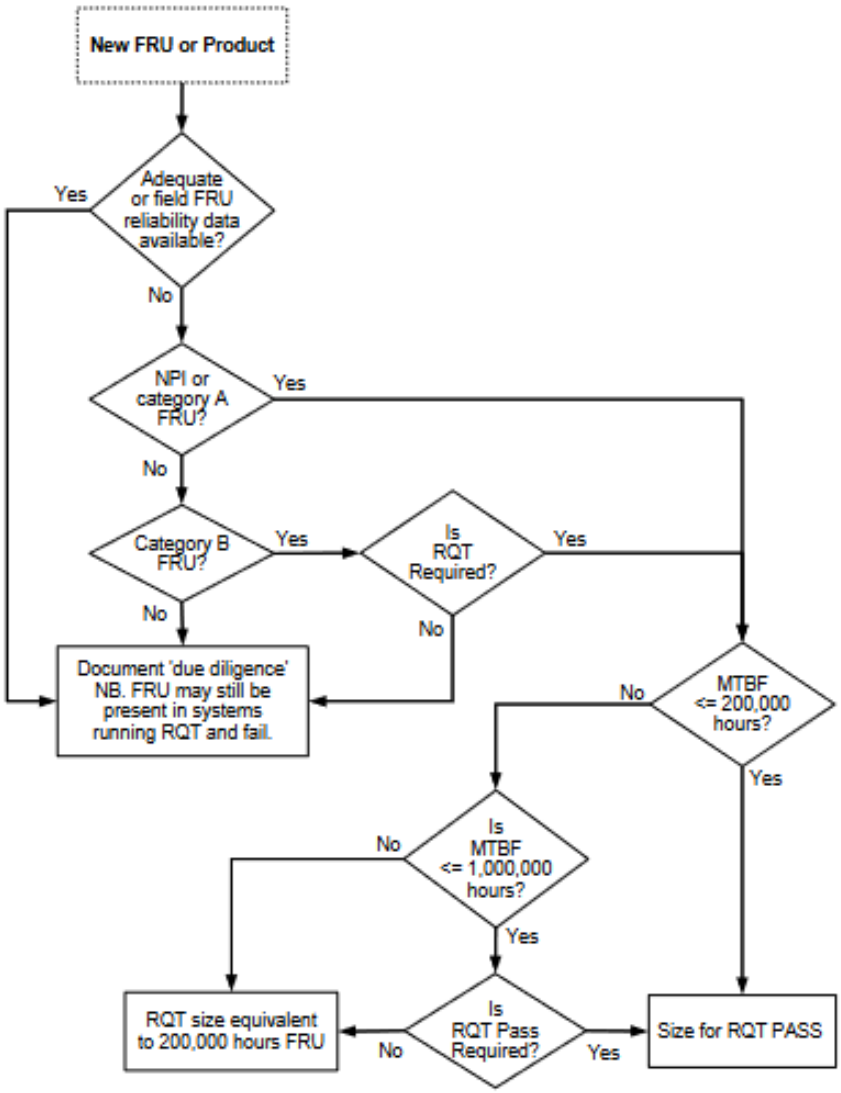

Figure 6-1 RQT Planning Flowchart

6.9 Using the RQT Planning Monitoring and Reporting Template

6.9.1 RQT FRU and System Configurations

In the FRUs sheet of the *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx, enter the information related to the FRUs that is tested. Then, in the configuration sheet, define the RQT system configurations and quantities.

6.9.2 RQT POH Targets

The POH required to pass RQT are defined and documented in the 'Plan' sheet of the *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx. On that sheet you must indicate the following:

- The UUT quantities and test durations for each system configuration
- Which FRUs are and are **not** being targeted for an RQT pass
- Which FRUs are being targeted for a 200K hour MTBF equivalency

If any results are leveraged from another platform, record evidence of due diligence to exempt FRUs from achieving an RQT pass in the qualification plan.

6.9.3 RQT System Monitoring

All RQT UUTs are monitored during the process and all test logs are recorded, archived, and made available to Oracle upon request. The POHs sheet of the *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx, must be used to log this data.

UUTs are monitored on an hour-by-hour basis to ensure that any failures are identified as soon as possible and the root cause of the failure is determined efficiently.

6.9.4 Reporting

RQT results must be reported on a daily or weekly basis (as defined by the product team) using *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx. The appropriate report page of that document, either for an NPI or FRU RQT, along with the 'fails' sheet, must be provided. When the RQT is completed, archive the final version of the RQT planning, monitoring, and reporting template according to the archival process detailed in https://serverras.oraclecorp.com/PHPS/rqt-ort/rqt.php.

Appendix A: Recommendations for Levels of Qualification

Table A-1 Recommendations for Levels of Qualification

Qualification Category	***Vendor Component Qualification***	***Engineer (Engr)/Operations (Ops) DVT/PVT or Pilot***	***Ops Platform RQT/RDT/ ETT/Other***
A	√	√	√
B	√	√	
C	**√**		

Change Impact	*Vendor Component Qualification*	*Qualification Category*
Reliability Performance Yield Form/Fit/ Function	**New product/FRU introductions** **New part numbers** **Any electrical or process changes in the following RAS critical FRUs:** • CPUs or processor modules • PSUs • SRAMs • DIMMs • E$ modules • Disk drives • SSD (Solid State Drive) • Oracle custom ASICs • Graphics cards • Fab changes (dash roll)	**A**
Minor changes to high reliability or Oracle-common items	• Active devices • Industry standard ICs • Passive components • Fan assembly • Connectors, cables • SSPs • Hubs • Routers • NICs and Host Bus adapters • GBICs • SW - OS, SSP SW, patches, firmware • Backup devices • Optical media devices • XATO components (excluding category A changes) • Other PCI devices • Commodity or off-the-shelf ASICs **Board fab:** • Minor layout (rev roll) • Stackup change • Component packages • Heat sink and attachment **Other process changes not in qual Category A (supplier or Oracle):** • Vendor, rework, fab, assembly, tests	**B**
Nonfunctional or cosmetic	• Multiple platform Category C components must complete Category B requirements	**B**

Change Impact	*Vendor Component Qualification*	*Qualification Category*
Nonfunctional or cosmetic	• Appearance package • Marking or labeling • Mechanicals • LEDs • Chassis	**C**

Appendix B: Qualification Test Responsibility Matrix

The responsibility matrix below describes the high-level deliverables in qualification test and associates each deliverable with a document paragraph and the person or organization responsible for providing the deliverable.

Qualification Process Requirement	*Paragraph*	*Responsible Individual(s) or Organization(s)*
Keep qualification status information up to date (using CIRTool).	1	Qualification team members with information on the qualification; PE, DE PM, Ops PM, Mfg personnel
Archive qualification plan and completion report documents and final PMRT for RQT.	1	PE responsible for the product
Assess the proposed change and determine the level of qualification testing that is required.	2.1	PE responsible for the product with input from the qualification team
Define the qualification quantities required. Use *SCO Products: Component Qualification Size Guidelines*, *923-3575-xx*, for PVT and *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx, if RQT is required.	2.1.2 2.1.3	PE responsible for the product
Generate the Qualification Plan and gain approvals (use *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx (RQT-PMRT).	2.3	PE responsible for the product is the primary author. (This plan could be drafted by other qualification team members but must be approved by the PE and the product team)
Schedule the qualification test.	3.1	Ops PM, in coordination with the Mfg site, and qualification team

Qualification Process Requirement	*Paragraph*	*Responsible Individual(s) or Organization(s)*
Ensure that there is adequate manufacturing resources (material, facility, personnel) to conduct the qualification test.	3.1	Manufacturing personnel
Execute and monitor the qualification test and generate periodic Qualification Reports. For RQT weekly (minimum) reports are required (use *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx).	3.2	Manufacturing personnel in coordination with the PE
Publish the final results and recommendations in the Qualification Completion Report (use *SCO Scalable Systems Group (SSG): Qualification Completion Report Template*, 913-3726-xx, in WebDocs).	4.1	PE responsible for the product
Disposition and release the qualification material upon test completion.	4.2	PE responsible for the product
Determine whether failures are chargeable to RQT.	6.2.2	RQT team
Drive FA and RCCA on all chargeable failures during qualification.	6.2.2	RQT team
Determine what actions to take in response to chargeable RQT failures.	6.2.3	Product Team
Create a CPAS record for all RQT failures, record fails on the PMRT, collect pertinent UUT logs.	6.5	Manufacturing personnel
If a fail is due to a design related issue, raise a CR record.	6.5	RQT team (most likely the DE)
Monitor RQT UUTs on an hour-by-hour basis, record and archive test logs (use *SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template*, 913-3572-xx, for recording the accumulating POHs).	6.1.4.1	Manufacturing personnel

NOTE 13: 'Manufacturing personnel' could be either external or internal to Oracle. There can be cases where PE responsibilities are largely filled by a PE from an external Mfg organization.

Appendix C: Sample Operations Qualification Report

```
QUALIFICATION/PILOT ACTIVITY REPORT

_____________________________________________________
Name of Issuing Department: Benchmark Dublin Engineering Dept.
Name of Sender: Seamus Collins
=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
PRODUCT: V480/V880                    MCO No: MC-1702
Date: 12th Nov 2003                   CIR No: 347
```

```
------------------------------------------------------------
MCO activity
Background: Alternate source,Core Cost Reduction.
Priority: Normal
Pass/Fail Criteria: PASS = 3 Allowable functional failure root caused to the DIMM
to give 91% confidence level.
Status = Green
Qual % complete: 0%
Expected qual completion date: 25-Nov-03.
Status at end of current shift
------------------------------------------------------------Cherrystone Scout
build Qualification
QTY@ QTY@ QTY@ QTY@ QTY@  QTY@   TOTAL   Units    Units
ASSY IST  SFT  VMI  Pack  PPA    FA/ARMs Complete Remaining
~~~~ ~~~~ ~~~~ ~~~~ ~~~~  ~~~~    ~~~~    ~~~~~~~~ ~~~~~~~~
 0    0    3    0    0     0       2        0        5

Daktari  Scout build Qualification
QTY@ QTY@ QTY@ QTY@ QTY@  QTY@   TOTAL   Units    Units
ASSY IST  SFT  VMI  Pack  PPA    FA/ARMs Complete Remaining
~~~~ ~~~~ ~~~~ ~~~~ ~~~~  ~~~~    ~~~~    ~~~~~~~~ ~~~~~~~~
 0    0    0    0    3     1       2        0        6

IST Yield: 81%
SFT Yield: 81%
PPA Yield: 100%
------------------------------------------------------------
Comments on issues or delays arising on current shift
------------------------------------------------------------
1 suspected qual related fail. Currently in FA
=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-
Cumulative Records
------------------------------------------------------------
Cumulative Fail Details
~~~~~~~~~~~~~~~~~~~~~~~~~~In FA
11th Nov-0346AN00BC Daktari IST Failed keyswitch test (NQR)
12th Nov-0346AN00B2 Daktari SFT Failed message check C8 (NQR)
12th Nov - 0346AN0112 Cherrystone SFT Failed Unix Boot C2 (QR)
                      Data or instruction Access error
                      cpu 2 DIMM J8000
12th Nov - 0346AN0115 Cherrystone IST Unit failed on POST for(NQR)
                      Safari cpu slot A
QR Qual Related
NQR  Not Qual Related
Cumulative Completed Units By Process Step for Cherrystone Scout/Qualification
=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
TOTAL    QTY@ QTY@ QTY@ QTY@ QTY@ QTY@  Total Units    Units
DATE     ASSY IST  SFT  VMI  Pack PPA   FA    Complete RMR
-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-
11th Nov  5    0    0    0    0    0    0       0       5
12th Nov  0    0    3    0    0    0    2       0       5
=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
Cumulative Completed Units By Process Step for Daktari Scout/Qualification
=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
TOTAL    QTY@ QTY@ QTY@ QTY@ QTY@ QTY@  Total Units    Units
DATE     ASSY IST  SFT  VMI  Pack PPA   FA    Complete RMR
```

```
=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
11th Nov  0     0     4     0     0     0     1        0         5
12th Nov  0     0     0     0     3     1     2        0         6
```

Reference Information

Reference Documents and Records

Document Title	***Number***	***ESO Controlled*** [1]		***Quality Record*** [2]	
		Yes	***No***	***Yes***	***No***
SCO Products: Reliability Qualification Test (RQT) Planning, Monitoring, and Reporting Template	913-3572-xx	x			x
SCO Scalable Systems Group (SSG): Qualification Completion Report Template (located in WebDocs)	913-3726-xx	x			x
SCO Product Lifecycle and Technology: Qualification and First Article Inspection Template	913-7020935-xx	x			x
SCO Quality: Ongoing Reliability Testing (ORT) Policy	914-1736-xx	x			x
SCO Chief Quality Office: Hardware Reliability Qualification Testing (RQT) Procedure	914-1746-xx	x			x
SCO Operations Engineering: Mechanical Part and Sub-Assembly Qualification and Approval Process	923-3402-xx	x			x
SCO Products: Component Qualification Size Guidelines	923-3575-xx	x1			x
SCO Quality: Corrective and Preventive Action Process	923-3644-xx	x			x
SCO Site Execution: Qualification Execution Process (located in WebDocs)	924-0315-xx	x			x
SCO Supplier Management: Supplier Engagement for Qualification – Manufacturing Readiness Test (MRT) Process for Hard Disk Drives	924-0601-xx	x			x
SCO ESO: Reviewing Change Orders	990-1015-xx	x			x

[1] All references to documents controlled by Engineering Services were current when this document was released. All hard copies of this document are to be used for reference only.

[2] For quality record information, refer to *WWOPS Quality: Control of Quality Records*, 923-1764-xx (in WebDocs).

Reliability Qualification Testing Policy For Oracle Systems Hardware Products Revision 3.3 : https://serverras.oraclecorp.com/RQT/RQT_Policy_3.3.html *(internal site)*	N/A		x		x
Halt, Hass, and Hasa Explained: Accelerated Reliability Techniques, by Harry W. McLean, ISBN number 0873894898.	N/A		x		x
MTBFTool: (restricted site) https://serverras.oraclecorp.com/HTMLS/RASSUITE/rassuite.html	N/A		x		x
NSG CIR Tool (Qualification Tracking Tool): https://cirtool.us.oracle.com/app	N/A		x		x

Document History and Approvals

Dash	Rev	Date	Description of Change	Originator
01	A	03 Jul 2006	Initial release.	N/A
01	B	24 Apr 2009	Update title and reference document titles. Format updates and changes.	N/A
02	A	08 Jun 2010	Updated document to improve qualification consistency across multiple groups.	N/A
03	A	23 Jun 2011	Added multiple platform component requirements.	N/A
03	B	15 Jul 2011	Updated note 9 and reference materials section to replace 923-1570-xx with 990-1015-xx.	N/A
Agile History				
Rev		***Date***	***Description of Change***	***Originator***
04		24 Feb 2015	Updated hyperlinks and section 6 to correctly reference *Reliability Qualification Testing Policy For Oracle Systems Hardware Products Revision 3.3* Removed obsolete documents 913-2659 and 913-3594. Added 923-3402 to Section 2.1.3.	N/A
Fusion History				
05		11 Jan 2023	Reformat to Redwood? Update from WWOPs to SCO. Change attachment category to Misc for PDF. No content changes.	N/A

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