ORACLE

Procedure

Cover Page

Systems Quality: Best Practices Guidelines for Manufacturing and Repair Vendors

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		Review Version:	A
Reason for Review:	Added statement - "The sub-tier audit should include processes that are used to manufacture all components qualified on Oracle products (even if they are currently not being purchased by Oracle or our EMs)" to Section 10.1 subsection Best Practice (clause 9) and subsection Acceptable Practice (clause 10). Removed reference to obsolete document 923-3578.		

Overview:

This document provides a quick reference guide that describes Best Practices, Minimal Acceptable Practices, and Unacceptable Practices utilized on and for Oracle systems, PCBAs, sub-assemblies, FRUs, and X-options.

The purpose of this Best Practices Guideline is to distribute information regarding Oracle's observed best practices. The intent is to allow all sites and all people who come in contact with Oracle products to know and implement the practices that contribute to the highest level of product quality. As Oracle global teams review facilities and practices, the practices noted here are used in making assessments of Oracle and supplier processes.

This guideline is not all inclusive and will continue to be a "work in progress" as best practices are continuously being created in the manufacturing and repair sectors. In the spirit of continuous improvement, it is our hope and expectation that current best practices will be superseded by newer, better practices.

Where there is a conflict between this guideline and Oracle and/or industry specifications, the contractual specification takes precedence. Contact your Oracle Engineer for clarification and resolution.
For External manufacturers: The AQP (Advanced Quality Plan - linked to the contract) is oracle's formal process for communicating specifications to Contract Manufacturers. The AQP specifications should be considered the point of reference by Contract Manufacturers. In the event there is a conflict, the AQP, additional product specifications, and applicable Industry Standards take precedence over this document.

Provide a brief explanation as to what the document is about.

Audience:

This document is for all Oracle employees and Tier 1 suppliers responsible for designing, manufacturing, repairing, handling, and shipping Oracle systems, PCBAs, FRUs, X-Options, sub-assemblies, components, and packaging. This includes Oracle factories, External Manufacturers, Repair Vendors, etc.

Provide a list of functional groups impacted by the document, each functional group requires at least one Approver.

Related Information

Reason for Change:

Added statement - “The sub-tier audit should include processes that are used to manufacture all components qualified on Oracle products (even if they are currently not being purchased by Oracle or our EMs)” to Section 10.1 subsection Best Practice (clause 9) and subsection Acceptable Practice (clause 10). Removed reference to obsolete document 923-3578.

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Questions and Comments

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Contents

Introduction

This document defines the best practices required when designing, manufacturing, repairing, and shipping/handling the Oracle systems, PCBAs, FRUs, X-Options, sub-assemblies, components, and packaging. The guideline enables the user to identify proven methods and reference known best practices in one centralized location.

The guideline includes topics on:

- Warehouse Practices
- Manufacturing, System Assembly, and Repair processes
- Packaging
- Palletization
- Rework & Repair
- Failure Analysis and Debug
- Site Quality
- Sub-tier supplier
- Export Practices

NOTE 1: Document users external to Oracle will be unable to access the internal links for documents.

1 Definitions

This chapter defines the terms Best Practices, Minimal Acceptable Practices, and Unacceptable Practices utilized on and for Oracle PCBAs and systems and commodities.

1.1 Best Practice:

This practice provides the highest rate of success, the greatest level of protection and quality, and the least potential to damage Oracle products. Where possible, Oracle expects all suppliers to aspire to this level of practice.

1.2 Minimal Acceptable Practice:

This is the lowest acceptable level of service. It provides a lower level of success or protection than the best practice for this activity. This practice can be regarded as a stepping stone towards best practice.

1.3 Unacceptable Practice:

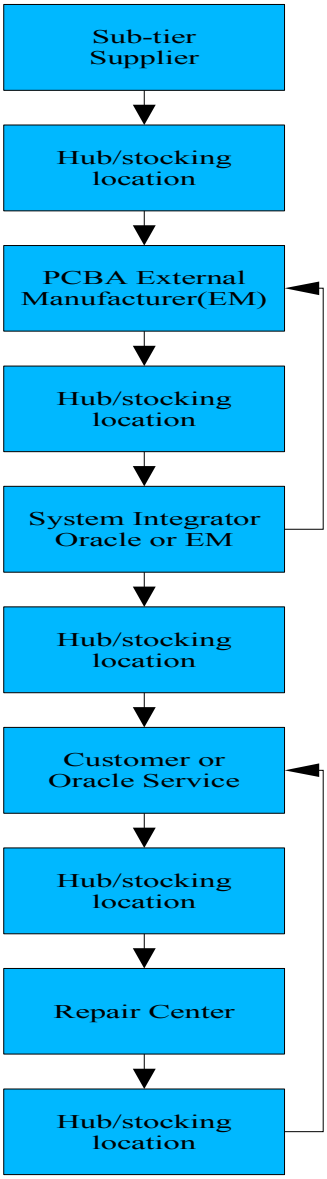
This practice is a potential risk to Oracle product quality, therefore it must be improved immediately. In some cases this practice can result in product shipment delays while the condition is brought to the minimal acceptable practice.

2 Product Lifecycle

Throughout its lifetime a Oracle PCBA (for example, a motherboard) or system may be shipped, handled, and processed at a variety of different facilities and locations.

Refer to *Figure 1, Example of an Oracle Motherboard Lifecycle,* on Page 7 which shows an example of the flow an Oracle motherboard may take during its lifetime. This is only an example; the actual flow of a specific board or system may vary significantly.

Figure 1, Example of an Oracle Motherboard Lifecycle



Sub-tier Supplier locations are sites where raw components are assembled and tested. This may include, but is not limited to, power supplies, memory, processors, FABs, ASICs, ICs, passive devices, and connectors.

PCBA External Manufacturers are suppliers that assemble Oracle printed circuit board assemblies.

Hub/Stocking Locations represent sites where material may be held between customer or operational sites, includes raw material.

System Integrator (Oracle or External Manufacturer (EM)) describes a site where systems or partial systems (FRUs) are assembled and tested.

Customer or Service Center are sites that use end product. Service may use this product at this stage as FRUs, field replaceable units.

Repair Center sites receive field failures and FRUs that need repair, they repair or rework them so that they can go back into the field as FRUs. The repair center may or may not be the original vendor or manufacturer.

Remote Stocking Location (RSL) is a location around the plant where FRU stock is maintained to allow for rapid deployment to Oracle Service Engineer

3 Warehouse Practices

3.1 Receiving

Best Practice:

1. There is a documented process and evidence that shows packaging is inspected to criteria per the process documentation and that there is a process for handling material with suspected damage.
2. Details of damaged deliveries, including photos, are captured and are linked with the delivery data for traceability and for use in case of future issues.
3. All material is bar coded with vendor, part number, purchase order, and date codes and/or lot codes.
4. All bar code information is scanned into a receiving database.
5. The receiving database automatically checks material for purchase order, vendor AVL status, and age of the material (not greater than two years old).
6. Incoming material vendor and date code information is automatically checked against past or current purges, stop ships, and block list.
7. There is an automated process that identifies whether the part is currently on DTS (Dock to Stock) status or flags the part for IQC (Incoming Quality Control).
8. Material is stored using FIFO (First In, First Out) according to age of the material.

Minimum Acceptable Practices:

1. Packaging is inspected to acceptable criteria per the process documentation.
2. All material is bar coded to Oracle or industry standards.
3. The Purchase Order is verified for vendor, Approved Vendor List (AVL) status and age of material (not greater than two years old).
4. There is a process to verify that the vendor is on Oracle and/or CM AVL and that part is active status (Oracle U, T, or Q status).
5. Part date code is less than 2 years old. Material greater than 2 years old may be used by Oracle Repair Vendors on Oracle products that are EOL.

6. Part Vendor and/or date code not impacted by a Purge or Stop Ship.

Unacceptable Practice:

One or more of items 1 through 6 of Minimal Acceptable Practice is not followed.

References:

950-1419-xx, *Specification of Identification Labels for Packaged Finished Goods*

950-4477-xx, *Identification, Labeling, and Bar Coding standards for Assemblies*

425-1016-xx, *Rejectable New Packaging Materials*

425-1017-xx, *Specifications and Used Packaging Material*

Industry Standards:

EIA-476-B, *Date Code Marking- partial revision of EIA 476-*A

JEDEC JESD97, *Marking and Symbols and Labels for Identification of Lead Free Assemblies, Components and Devices*

3.2 Incoming Quality Control

Goal:

Ensure that processes are in place to prevent quality issues and out-of-spec parts from entering the factory.

Definitions Used:

Part – A component or assembly which includes FABs, packaging, power supplies, sub-assemblies, chassis, boards, ICs, resistors, capacitors, etc.

New part – A new or changed part for an Oracle product coming from any source. An unchanged part for an Oracle product coming from a new facility or a new supplier

Best Practice:

1. A First Article Inspection (FAI) process is in place for all new and all modified parts and for parts from new suppliers. The FAI verifies product specifications and all critical to function dimensions.
2. Incoming sample inspection to a 0.65% Acceptable Quality Level (AQL) level shall be performed. Parts are placed on "Dock to Stock" status after successful sampling to 0.65% AQL is achieved
3. Specifications and drawings on all incoming parts are electronically available in Incoming Quality Control.
4. Calibrated equipment (templates, measuring devices, and such) is available in Incoming Quality Control to check the conformance to specification and critical to function dimensions of incoming critical parts (for example, PCBs, packaging, chassis).
5. The supplier maintains a global electronic repository for FAIs. All FAIs are stored in this repository. This global repository is available to and is used by all supplier locations that produce Oracle products.
6. There is a documented inspection process to track specifically identified/agreed critical parts and critical to function dimensions. The inspection results are stored in an electronic record with a 10 year availability.
7. "Dock to Stock" status expires after six months, whereupon sample inspection to a 0.65% AQL level shall be performed. If results are favorable, the part shall go back onto Dock to Stock. Repeat every six months.

8. SPC control charts, with lot rejection criteria, are available and used for all critical electronic and mechanical parts.

9. ESD Best Practice (Section *9.1, ESD Controls,* on Page 80) are followed when handling all ESD sensitive electronic components. Inspected components are repackaged using ESD safe materials. Opened cartons are closed.

10. Evidence exists to confirm that there is minimal or no history of non-conforming material from Sub-tier Suppliers disrupting production.

Minimal Acceptable Practice:

1. A FAI process is in place for all new and all modified parts and for parts from new suppliers. The FAI verifies product specifications and all critical to function dimensions.

2. Incoming sample inspection to a 0.65% AQL level shall be performed. Parts are placed on “Dock to Stock” status after successful sampling to 0.65% AQL is achieved.

3. Specifications and drawings on all incoming parts are available in supplier's Incoming Quality Control (IQC).

4. Calibrated equipment (templates, measuring devices, etc.) is available in IQC to check the conformance to specification and critical to function dimensions of incoming critical parts (e.g., PCBs, packaging, chassis).

5. The supplier maintains a local repository for FAIs. All FAIs are stored in this repository. Information on FAIs is made available to other supplier locations upon request.

6. There is a documented inspection process to track specifically identified/agreed critical parts and critical to function dimensions. The inspection results are stored in an electronic record with a five year availability.

7. Doc-to-Stock status is achieved, and it stays in place until a problem occurs or there is a change to form, fit, or function.

8. Acceptable ESD practices are followed when handling all ESD sensitive electronic components. Inspected components are repackaged using ESD safe materials. Opened cartons are closed

9. Evidence exists to confirm that there is minimal or no history of non-conforming material from Sub-tier suppliers disrupting production.

Unacceptable Practice:

One or more of items 1 through 9 of Minimal Acceptable Practice on Page 11 is not followed.

References:

914-1756-xx, WWOPS Quality: IQC/DTS Minimum Expected Specification

Mil Standard 105E, and Mil 1019, *Sampling Procedures and Tables for Inspection by Attributes* **or ANSI/ASQC Z1.4-1993**

ISO 9001:2000, Quality management systems – Requirements

3.3 Material Management and Storage

Best Practice:

1. All material is logged into and managed by an automated inventory control system that enforces FIFO (to age of material month/day/year) control of all material. All material is stored allowing FIFO access.
2. There is an effective process for storing and controlling the exposure of moisture sensitive parts (J-STD-033).
3. Temperature and humidity are monitored, recorded, and controlled 24/7 throughout the warehouse to meet Oracle system/component operating and non-operating specifications.
4. ESD Best Practices are followed wherever ESD sensitive components are handled.
5. Warehouses are neat, clean, and well organized. All material is labeled and stored in its proper place.
6. All parts and components are stored such that they are protected from ESD and physical damage.
7. Oracle stacking and palletization specifications are followed for the storage of all Oracle systems, boards, and parts.
8. High value parts are stored in a locked, high-security area that is managed by an automated inventory control system that enforces FIFO control of all material. Access to this area is badge controlled.

9. Security practices are in place that prevent the theft and inadvertent misplacement of Oracle products and parts.

Minimal Acceptable Practice:

1. All material is logged into and managed by an inventory control system. There is FIFO (to age of material month/year) control but it is not necessarily designed to be mistake-proof. Material is stored to allow FIFO access.
2. There is an effective process for storing and controlling the exposure of moisture sensitive parts (reference J-STD-033).
3. Temperature and humidity are monitored, recorded and controlled 24 hours/7 days a week to meet Oracle product/component operating and non operating specifications.
4. Section 9.1, *ESD Controls,* Minimal Acceptable Practice on Page *81* are followed wherever ESD sensitive components are handled.
5. Warehouse cleanliness and organization is fair/adequate but needs some improvement. There may be material that is not boxed, not labeled and/or is not stored in its proper place.
6. All parts and components are stored such that they are protected from ESD and physical damage.
7. Oracle stacking and palletization specifications are usually followed for the storage of all Oracle systems, boards, and parts.
8. High value parts are stored in a locked secured area that is managed by an automated inventory control system. The FIFO system employed in this area may or may not enforce FIFO control of all material. Access to this area is controlled.
9. Security practices are in place that prevent the theft and inadvertent misplacement of Oracle products and parts

Unacceptable Practice:

One or more of items 1 through 9 of Minimal Acceptable Practice above are not followed.

References:

923-2001-xx, *WWOPS Manufacturing: Global Cosmetic Quality and Workmanship Standards*

J-STD-033, *Standard for Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices*

425-1019-xx, *Pallet Requirements for Shipping Inbound and Outbound*

950-1009-xx, *Fabrication Specification Printed Wiring Boards*

4 Manufacturing, System Assembly, Repair Processing

4.1 Kitting and Material Stocking at Assembly

Best Practice:

1. All stocking locations (bins, shelving, carts, and such) are labeled with the part number and inventory/sub-inventory identifier.
2. All high-value parts such as CPUs and DIMMs are stored in a secure area or storage unit.
3. Operators wear ESD control devices when removing static-sensitive devices from shielding bags or other protective containers.
4. Material greater than two years old is not used in the manufacturing process. Exceptions must be approved by Oracle WWOPs Engineering. Material greater than two years old may be used by Oracle Repair Vendors on Oracle products that are EOL.
5. All part numbers are checked for accuracy.
6. All material pulled for the production order is stored on a cart so that it is protected from damage of any nature; physical, ESD, and particle.
7. Parts are pulled for production orders on a FIFO basis.
8. The FIFO process is automated and/or designed to be mistake-proof to prevent newer material from being pulled before older material.
9. In-process and completed kits are stored in a controlled or limited-access area prior to being moved to the production line.

10. Stock Material is stocked in its original shipping packaging until it is installed or configured to avoid any cosmetic or mechanical damage to sensitive material.
11. Static-sensitive material is kept inside sealed shielding bags until installation or configuration.
12. Provide padding to shelving, conveyor, and workbenches where material may contact it during removal from packaging.
13. Bins of free stock are color coded to separate and identify material for a given product line(s).
14. A process is in place to segregate RoHS from non-RoHS material and to prevent cross contamination between RoHS and non-RoHS material
15. The quantity of material in all stocking locations is controlled with the use of Kanban cards or min/max quantities.

Minimal Acceptable Practice:

Items 1 through 7 of Best Practices on Page 14 are followed.

Unacceptable Practice:

One or more of items 1 through 7 of Best Practices on Page 14 are not followed.

References:

923-2001-xx, *WWOPS Manufacturing: Global Cosmetic Quality and Workmanship Standards*

4.2 Cart Design and Usage

Definitions:

Conductive: < 1x10^4

Dissipative:> or =1x10^4 and <1x10^11

Best Practice:

1. All surfaces of the cart including paints or coatings are either static dissipative or anti-static.
2. All casters are either conductive or static dissipative, and cart is equipped with a conductive drag chain that makes at least 12 inches of contact with the floor.

3. If work is performed on the cart, all work surfaces are covered with a conductive or static-dissipative mat.
4. Static-sensitive material is stored in shielding bags or Faraday cages.
5. The loaded cart does not impede visibility during movement such that product or operator safety is at risk.
6. If assembly operations are performed on the cart, the primary surface is adjustable to allow for a work height between 32” and 40” from the floor.
7. Cart is equipped with:
   a) A brake that is activated by a single foot-actuated pedal
   b) Padding or elastomeric bumpers on all four upper corners
   c) Elastomeric bumpers on all four lower corners
   d) Swivel casters at the front and fixed casters at the rear
   e) Dedicated handle(s) for pushing and maneuvering
8. If product is stored on the cart, covers, bags, or cages, protect the product from dust and ESD.
9. PCBA assemblies are stored on edge, not horizontally (flat).
10. PCBAs are stain-gauge tested as required by *WWOPS Sparc Volume Operations: Strain Gauge Test Procedure*, 914-1739-xx, to ensure no damage is done to them during placement, movement, and removal.
11. The load rating of the cart is two times the maximum expected load; in other words, the safety factor is 2.0.
12. Unpackaged product/material does not protrude beyond the front, rear, or sides of the cart.
13. The cart does not tip easily under ordinary operating conditions.
14. Loading or unloading will not damage product such as dislodging small board components or scratching cosmetic class A1, A, B, or C surfaces beyond acceptable limits. The cart is free of burrs, sharp edges, and corners.
15. The cart is free from corrosion. There is no evidence of paint flaking.

Minimal Acceptable Practice:

1. The cart is equipped with either a conductive drag chain or two conductive or static-dissipative casters in opposite corners.
2. Static-sensitive material is stored in shielding bags or Farraday cages.
3. Cart has a brake on at least one wheel.
4. The load rating of the cart is equal to or greater than the maximum expected product load.
5. PCBA are stored according to product requirements.
6. Items 10 through 13 of Best Practice on Page 16 are followed.

Unacceptable Practice:

One or more items 1-6 of the Minimal Acceptable Practice on Page 17 are not met.

References:

ANSI/ESD S20.20-1999, *For the Development of an Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)*

914-1739-xx, *WWOPS Sparc Volume Operations: Strain Gauge Test Procedure*

4.3 Chemical Control

Goal:

All local, federal, and national regulations regarding chemical safety, recycling, labeling and usage are understood and complied with. If a conflict exists with the below listed practices, local, federal, and national government regulations take priority.

Best Practice:

1. All chemical containers (including bulk containers) are clearly labeled with:
   a) Content, chemical name, brand name, and manufacturer
   b) Date of manufacture
   c) Date first opened

d) Expiration date

e) "No expiration" if chemical does not expire

2. A documented, automated process is followed to ensure expired chemicals are never used.

3. A process is in place to segregate RoHS from non-RoHS material and to prevent cross contamination between RoHS and non-RoHS material.

4. Chemicals are stored and distributed per manufacture's recommended procedure.

5. Factory, industry, emergency procedures, and safety requirements are being met with respect to chemical control and identification management.

6. Routine training, with periodic update training is provided to all employees. This training includes, but is not limited to, checking for expiration dates, proper controls, labeling, proper disposal, and Material Safety Data Sheet (MSDS).

7. Material Safety Data Sheets are stored in a central repository.

8. There is a documented method to dispose of all waste materials.

Minimal Acceptable Practice:

1. Individual containers are not necessarily labeled (or labeled without complete information), but complete label information is available separately from the container. Individual containers at a minimum are labeled with the contents.

2. A documented process is followed that ensures expired chemicals are never used.

3. A process is in place to segregate RoHS from non-RoHS material and to prevent cross contamination between RoHS and non-RoHS material.

4. Chemicals are stored and distributed per manufacture's recommended procedure and regulatory mandate.

5. Factory, industry, emergency procedures, and safety requirements are being met with respect to chemical control and management.

6. Routine training, with periodic update training, is provided to all employees. This training includes but is not limited to checking for expiration dates, proper controls, labeling, proper disposal, and Material Safety Data Sheet (MSDS).

Unacceptable Practice:

One or more of items 1 through 6 of Minimal Acceptable Practice above are not met.

4.4 Process Documentation

Best Practice:

1. Process documentation is available on line at the location where the process is performed (i.e., Operators do not need to leave their work location to refer to the process documentation).

2. All processes are clearly defined and are easily understood by all operators who perform the process and by their managers. All process documentation accurately represents the process to be executed.

3. Process documentation is controlled so that every hard copy or viewable copy is the current approved version.

4. Process documentation relies more on graphical representation e.g., video, color images, color photos, diagrams, flow charts and less on verbal instructions to define the processes.

5. Employees are tested for understanding and competence of all required process documentation on a regular basis.

6. Records are maintained of employee test results.

Minimal Acceptable Practice:

1. Process documentation is easy accessible to all operators who perform the process. Process documentation is available at the location where the process is performed.

2. Process documentation is controlled so that only current revision is accessible.

3. All processes are clearly defined and are understood by all operators who perform the processes and by their managers.

4. Employees are trained and their understanding tested for all required process documentation.

5. Records are maintained of employee test results.

Unacceptable Practice:

One or more of items 1 through 4 defined in Minimal Acceptable Practice above are not met.

4.5 Assembly Process

Best Practice:

1. The assembly process is laid out in a manner that minimizes board/system handling.
2. All operator workstations are designed/organized to allow the operator to perform the operation in an efficient, error-free manner (e.g., workspaces include space to allow operators to record information so that the Oracle product is never used as a writing surface).
3. All tools used by the operators are clearly labeled and/or color coded. They are maintained to specification on a regular maintenance schedule. They are labeled with last and next calibration dates.
4. Fixtures are maintained to specification on a regular maintenance schedule. They are labeled with last and next calibration dates.
5. All material is supplied to the assembly line and the operator stations in an efficient manner that eliminates process disruption.
6. All supply bins are clearly labeled with the individual part number. Only one part number is permitted per bin.
7. The assembly line is free of all non-essential material.
8. All non-conforming or discrepant material is segregated from the assembly or repair process as soon as it is identified as non-conforming or discrepant.
9. Process documentation is available to the operators at their workbenches. The operators execute the process as documented.
10. A dated picture/name of each operator certified to perform the operation is displayed at the workbench where the operation is performed. Only certified operators are permitted to perform the operation without supervision.

11. The shop floor control system permits only certified personnel to perform the operation. This is controlled via operator/engineer badge swipe.
12. Fixtures have been designed and implemented where required to minimized board/system damage and where required to ensure the integrity of the operation being performed.
13. All serialized parts structured to the board/system are scanned and assigned into the shop floor system at the point of installation into the board/system.
14. All process yields are monitored using SPC. Evidence exists that timely, effective action has been taken in response to process out of control events.
15. Where possible all process are controlled to ensure the process/installation is performed within the limits required.
16. The assembly line is managed to facilitate maximum error free throughput. The assembly line is balanced to the extent possible.
17. All operational steps have been designed to be mistake-proof.
18. The supplier has documented and implemented a policy that prevents operator effects (e.g., jewelry, hair, clothing, from interfering with the operation being performed).

Minimal Acceptable Practice:

1. Items 1 through 9 of Best Practice on Page 20 are followed.
2. Only certified operators are permitted to perform the operation without supervision.
3. All processes may not yet be controlled. However, the site has an active program with dates/milestones to achieve the required process control.
4. All operational steps are not necessarily designed to be mistake-proof.
5. The supplier has a policy that prevents operator effects (e.g., jewelry, hair, clothing, from interfering with the operation being performed).

Unacceptable Practice:

1. One or more of items 1 through 9 of Best Practice on Page 20 are not followed.
2. All processes may not yet be controlled. The site does not have an active program with dates/milestones to achieve the required process control.

References:

IPC-A-600, *Acceptability of Printed Boards*
IPC-A-610, *Acceptability of Electronic Assemblies*
IPC-CM-770, *Component Mounting Guidelines for Printed Boards*
IPC-SM-840, *Qualification and Performance of Permanent Solder Mask*
IPC-TM-650, *Test Methods Manual - Bow & Twist*
J-STD-001, *Requirements for Soldered Electrical and Electronic Assemblies*
J-STD-033, *Standard for Handling, Packing, Shipping, and Use of Moisture/Reflow Sensitive Surface Mount Devices*

4.6 Fixtures and Tooling

Definitions:

Tooling: Equipment, dies, molds, devices, aids, gauges, models, drawings, software programs (including test programs) that are used in the development, manufacture, repair or test of Oracle prototypes or products

Fixture: A physical device used to protect and/or enable the manufacturing, testing or repair of an Oracle system or board. Fixtures are usually stationary (except for board handling fixtures) and do not move through the process with the system or board. Examples of fixtures are: ICT fixture, BFT fixture, pneumatic DIMM insertion fixture.

Jig: Same as fixture

Best Practice:

1. All tools and fixtures are labeled with a unique ID and Oracle asset tag (if required).
2. Supplier maintains an accurate inventory record which documents the supplier identification number, Oracle asset tag (if, required), serial number etc), description, revision level, location, and condition of all tooling. This record also indicates whether the tool is in active use or not.
3. All tooling preventative maintenance schedules are in a database with automatic notification to the responsible supplier group. An auto-escalation process is in place.
4. Supplier maintains records of all changes and maintenance performed on tooling.

5. Cpk (Process Capability statistical process control measurement of process capability) analysis is performed on all tooling. Gage R&R is performed on all fixtures.
6. Supplier provides quarterly status reports on all tooling.
7. Supplier has copies of all documentation associated with theTooling including, but not limited to, drawings, CAD files, specifications, and maintenance records.
8. Supplier reviews and updates all documentation on a periodic basis to ensure that they are current and accurately reflect the current state of the Tooling/Fixtures.
9. Supplier maintains all Tooling specifications, drawings, and documentation for a period of 7 years following the last shipment date of the associated product or through the life of the service agreement, whichever is longer.
10. Supplier records the number of parts produced from a given tool/mold and proactively monitors the remaining useful life

Minimal Acceptable Practice:

1. All tools and fixtures are labeled with a unique ID and Oracle asset tag (if required).
2. Supplier maintains an accurate inventory record which documents the identification number, description, location, and condition of all tooling.
3. All tooling/fixtures are tagged and logged on a preventative maintenance schedule.
4. Supplier records of all changes and maintenance performed on tooling and fixtures.
5. Supplier has copies of all documentation associated with the tooling, including but not limited to, drawings, CAD files, specifications, and maintenance records.
6. Supplier reviews and updates all documentation on a periodic basis to ensure that documentation is current and accurately reflects the current state of the Tooling/Fixtures.

7. Supplier maintains all tooling specifications, drawings, and documentation for a period of 7 years following the last shipment date of the associated product or through the life of the service agreement, whichever is longer.

Unacceptable Practice:

One or more of items 1 through 7 of Minimal Acceptable Practice on Page 23 are not followed.

Reference:

MSA Tooling Exhibit

4.7 Processor Installation, Removal, Cleaning, and Replacement

Definitions Used:

Class 1 Processor – Land Grid Array (LGA) processor using a solid metal contact pin socket (e.g., as used on AMD rev F and Intel processors). This socket is soldered to the board.

Class 2 Processor – LGA processor using an interposer type socket e.g., Cinch type connector (fuzz button contact) used for UltraSPARC on Uniboard, V490/V890 and Niagara. This socket is a removable socket.

Class 3 Processor – PGA (Pin Grid Array) into a ZIF (Zero Insertion Force) socket, e.g., used for UltraSPARC on V215/V245. This socket is soldered to the board.

Class 4 Processor – Direct attach processor. Soldered to the board, e.g., Niagra2, Rock, Victoria Falls.

Pre-load – A force or weight applied evenly to the top of a heat sink to prevent rocking of the heatsink during installation and removal of the heatsink. Rocking of the heatsink could cause cracking of the CPU. For Best Practice a preload fixture is used. For Minimal Acceptable practice the operator may use a finger(s) for the preload.

Best Practice:

1. **Processor Handling:** If handling is required, all processor classes are handled with clean, lint free, ESD safe gloves only (never with bare hands, dirty gloves, or powder coated gloves).

2. **ESD:** ESD grounding measures (e.g., wrist straps) are always used for all processor classes.

3. **Processor Cleaning:** Any new or used Class 2 processor that shows any signs of residue or contamination is cleaned according to 's document, *WWOPS SPARC*: S*PARC Processors Cleaning Procedure at Disassembly*, 914-1760-xx or other Oracle approved processor cleaning process. All other processor classes are cleaned using ESD compliant materials and equipment.

4. **Cleaning Thermal Grease:** Whenever a Class 2 CPU assembly that uses thermal grease is disassembled, the CPU is cleaned according to Oracle's document, *WWOPS SPARC*: S*PARC Processors Cleaning Procedure at Disassembly*, 914-1760-xx.

5. **Residual Debris Cleaning**. Residual debris is removed using a cleanroom ESD safe vacuum. The filter is maintained (checked at least monthly) and cleaned/replaced on a regular schedule.

6. **Processor Installation:** Installation of processor Classes 1, 2, and 3 is performed using a vacuum pen that is tested daily for hold force and hold time. Hold force is two times load or greater. Hold time is two (2) times install time or greater (¾ inch, or larger, suction cup recommended). Installation of class 4 processors is performed using an SMT process.

7. **Heatsink Installation:** All heat sinks are visually inspected prior to installation to ensure mechanical integrity e.g., fin alignment. A preload fixture is used to prevent cracking of the CPU. Heat sink attach is performed to the sequence (cross pattern) specified for the particular Oracle product, using torque drivers calibrated to the Oracle specification for the particular Oracle product. Staged torquing (where the first stage is a lower value or a hand torque) is used when specified for the particular Oracle product. The installation process is designed to be mistake-proof to the extent possible.

8. **Heatsinks with Thermal Grease:** Heatsinks with thermal grease are sent back to the factory of origin for reapplication of thermal grease or an Oracle approved reapplication process is used.

9. **Heatsink Removal:** Class 2 and 3 heat sinks are removed using a preload fixture and staged torquing to prevent rocking/cracking. All screws are removed in the specified cross pattern using torque drivers calibrated for the specific Oracle product.

10. **Class 1 and 2 Processor Removal:** Class 1 and Class 2 processors are removed using an ESD safe stick (orange stick) – COM-KYL SH-83 or equivalent.

11. **Class 3 Processor Removal:** Class 3 processors are removed using a vacuum pen.

12. **Class 4 Processor Removal:** Class 4 processors are removed using an approved BGA rework procedure.

13. **Socket Reuse:** Class 2 (interposer type sockets). Sockets are not reused. Used sockets are marked and scrapped. When Processor Class 2 sockets are removed, PCB pads are cleaned using the specified cleaning fluid.

14. **Socket Removal:** Class 1 and Class 3 sockets are removed following the socket vendor's written instructions.

15. **Work Bench:** All processor processes are performed on a laminar flow bench with ionized air.

Minimal Acceptable Practice:

1. **Processor Handling:** If handling is required, processor Classes 1 and 2 are handled with clean, lint free gloves only--never with bare hands, dirty gloves, or powder coated gloves. Processor class 3 is handled with bare clean hands on edges only.

2. Best practices items 2 through 4 on Page 24 and 9 through 14 on Page 25 are followed.

3. **Residual Debris Cleaning:** If forced air is used to clean a processor, it must be filtered ionized forced air. The filter is maintained (checked at least monthly) and cleaned/replaced on a regular schedule.

4. **Installation:** Processor class 1 may be installed by hand. Installation of processor Classes 2 and 3 is performed using a vacuum pen that is tested daily for holding force. Installation of class 4 processors is performed using an SMT process.

5. **Heatsink Installation:** All heat sinks are visually inspected prior to installation to ensure mechanical integrity (e.g., fin alignment). A preload is used to prevent cracking of the CPU. Heat sink attach is performed to the sequence (cross pattern) specified for the particular Oracle product, using torque drivers calibrated to the Oracle specification for the particular Oracle product. Staged torquing (where the first stage is a lower value or a hand torque) is used when specified for the particular Oracle product.

6. **Heatsink Removal:** Class 2 and 3 heat sinks are removed using preload and staged torquing to prevent rocking/cracking. All screws are removed in the specified cross pattern using torque drivers calibrated for the specific Oracle product.

7. All processor processes are performed on a clean, ESD safe, protected (three sides and top) work surface with ionized air available at the work station.

Unacceptable Practice:

One or more of items 1 through 7 of Minimal Acceptable Practice above are not met.

References:

914-1760-xx, *WWOPS SPARC: SPARC Processors Cleaning Procedure at Disassembly*

4.8 DIMM Installation and Handling

Goal:

DIMMs are handled, installed and removed using practices that ensure that the DIMMs and DIMM connectors are not damaged. DIMMs are always protected against ESD damage.

Best Practice:

DIMM Handling

1. DIMMs are always protected against ESD damage.

2. DIMMs are only handled on the edges, whenever possible. A possible exception is that in removing DIMMs from the DIMM tray it may be necessary to touch the DIMM components.

3. DIMMs are never held, stacked, or stored touching another DIMM.

4. The contact fingers of the DIMMs are never touched.

5. Dropped, twisted, bent, or handling related damaged DIMMS are scrapped at the EM or RV.

6. DIMMs are stored in covered ESD DIMM trays.

DIMM Installation

1. The operator opens all latches on the DIMM sockets completely.
2. Prior to DIMM insertion the operator inspects the DIMM edge connector and the DIMM socket for debris, bent pins, or other irregularities. If any of these are present the board is rejected.
3. Align the DIMM at the top of the socket, and ensure that latches and keys fit properly in the appropriate DIMM notches.
4. The DIMMS are installed applying uniform pressure across the top of the DIMM.
5. The process to ensure uniform pressure across the top of the DIMM is documented.
6. A tool with calibrated force (e.g., Pneumatic) is used to install the DIMM with even pressure across the top of the DIMM.
7. The tool has been calibrated and regulated to the DIMM.
8. The tool has been characterized using strain gauge testing and complies with Oracle's strain gauge specification. The tool has been approved by Oracle WWOPs Engineering.
9. The tool is maintained to a regular schedule. Maintenance records are available.
10. Upon completion of DIMM insertion, the operator inspects to ensure that the connector latches are locked in place.

DIMM Removal

1. The operator unlocks both latches simultaneously. To prevent the DIMM from popping out, the operator supports the top edge of the DIMM with fingers.
2. If it is not possible to depress both latches simultaneously, one latch may be depressed while supporting the DIMM along the top edge, followed by the second latch.
3. DIMM removal is performed touching only the edges of the DIMM.
4. The DIMM is placed back into an appropriate DIMM carrier or packaging.

Minimal Acceptable Practice

DIMM Handling (Same as Best Practice on Page 27)

DIMM Installation

1. The operator opens all latches on the DIMM sockets completely.
2. Prior to DIMM insertion the operator inspects the DIMM edge connector and the DIMM socket for debris, bent pins, or other irregularities. If any of these are present the board is rejected.
3. Align the DIMM at the top of the socket and ensure that latches and keys fit properly in the appropriate DIMM notches.
4. The DIMMS are installed applying uniform pressure across the top of the DIMM.
5. The process to ensure uniform pressure across the top of the DIMM with a single press is documented.
6. A hand held tool, which places uniform pressure across the top of the DIMM, may be used to install the DIMM.
7. If a tool is used, it has been properly aligned to the DIMM (i.e., it avoids pressure on the heat spreaders and components).
8. The tool has been characterized using strain gauge testing and complies with Oracle's strain gauge specification. The tool has been approved by Oracle WWOps Engineering.
9. The tool is maintained to a regular schedule. Maintenance records are available.
10. Upon completion of DIMM insertion, the operator inspects to ensure that the connector latches are locked in place.

DIMM Removal (same as Best Practice on Page 28)

Unacceptable Practice:

1. One or more of Best Practice on Page 28 are not followed.
2. The DIMMs are "rocked" into place - one side first than the other. Rocking of DIMMs into place is never permitted.
3. DIMMs are installed touching the components of the DIMM for pressure.

4. DIMMs are removed with screwdriver or similar hooking through the holes in the PCB.

4.9 Test

Definitions:

Process Test – Testing to validate correct assembly prior to actual functional test, i.e., all testing prior to initial systems test (for example, ICT, BFT, commodity tests)

Product/System Test – Testing to validate basic functional operation

Product Reliability Test – Testing to validate product reliability over time

Audit Test – Testing to validate Customer Experience

4.9.1 Process Test

Best Practice:

1. The process test validates that all components/sub-assemblies are assembled to the current BOM and validates that components tested below actual tolerance levels have additional visual inspection.
2. The process test includes a formal mechanism by which yields are monitored using SPC and associated methodologies and that actions are taken upstream to minimize risk of issues before goal levels are exceeded.
3. The process test includes an automated mechanism by which repeated failures for common cause result in a suspension of manufacturing until a corrective action is in place.
4. The process test includes an automated limit on the amount of failures and the aging of failures which can be 'open' against a process.
5. The process test includes an automated mechanism by which all result data, manual and electronic can be validated, actioned real time and archived for real time interrogation.
6. The Inspection stages are conducted within an environment which allows detection of issues above the Oracle specification (*WWOPS Manufacturing: Global Cosmetic Quality and Workmanship Standards*, 923-2001-xx), including but not limited to lighting, training, and traceability of operator to product.

7. In-process and customer results are used to retrain, re-certify/decertify operators as needed.

8. Regular verification against customer reported failures is conducted and action plans tracked for completion (e.g., Plan Do Check Act).

9. Oracle customer data is available to the supplier and the supplier's employees and used to drive regular continuous improvement activities (Oracle PE/SE supply data feeds where automated delivery or direct access not available on at least a weekly basis).

Minimal Acceptable Practice:

1. The process test validates that all components/subassemblies are assembled to the current BOM.

2. The process test includes a formal mechanism by which yields are monitored and failures to a pre-determined goal are highlighted and actioned with the previous tier supplier.

3. The process test includes a mechanism by which repeated failures for common cause result in a suspension of manufacturing until a corrective action is in place

4. The process test includes a limit on the amount of failures and the aging of failures which can be 'open' against a process.

5. The process test includes a mechanism by which all result data, manual and electronic can be recovered and archived

6. The Inspection stages are conducted within an environment which allows detection of failures to the Oracle specification (*WWOPS Manufacturing: Global Cosmetic Quality and Workmanship Standards*, 923-2001-xx) including but not limited to lighting, training, and traceability of operator to product.

7. In process and customer results are used to retrain, re-certify/decertify operators as needed.

8. Regular verification against customer reported failures is conducted and action plans tracked for completion (e.g., Plan Do Check Act).

9. Oracle customer data is available to the supplier and the supplier's employees and used to drive quarterly continuous improvement activities. (Oracle PE/SE

supply data feeds where automated delivery or direct access not available on at least a weekly basis.)

Unacceptable Practice:

One or more of Minimal Acceptable Practice on Page 31 are not followed

References:

923-2001-xx, *WWOPS Manufacturing: Global Cosmetic Quality and Workmanship Standards*

4.9.2 Product Test

Best Practice:

1. The product test automatically validates that the product is assembled to the current BOM. The test should include automated tests for over and under consumption of material (e.g., ensure no extra nor missing memory devices).
2. The product test should automatically ensure that all configuration rules/design considerations are met (e.g., Slot positions, Mix constraints).
3. The product test validates the functionality of all of the user accessible features of the product, this includes but is not limited to Drive ejection and insertion, Button and LED actuation and validation, and interface connections.
4. The product test includes identified targeted redundancy/overlap to eliminate the risk of escapes to the customer base
5. The product test includes clearly defined individual and grouped segments of functionality test with clear and unambiguous diagnostic messages for investigatory use.
6. The product test includes power cycling (Soft and Hard) and upgrading validations in line with normal product usage expectations and where such power cycling will not affect the desired operation of the Product.
7. The product test failures are tracked, and the test process continuously altered in a controlled fashion to optimize the effectiveness of the test. In this instance effectiveness means earlier detection of failures (Effectiveness measures to be maintained).
8. The product test is designed in a manner which allows high skill roles to be grouped and performed optimally if at all. The product test includes a formal

mechanism by which yields are monitored using SPC and associated methodologies and that actions are taken upstream to minimize risk of issues before goal levels are exceeded.

9. The product test includes an automated mechanism by which repeated failures for common cause result in a suspension of manufacturing until a corrective action is in place.
10. The product test includes an automated limit on the amount of failures and the aging of failures which can be “open” against a process.
11. The product test includes an automated mechanism by which all result data, manual and electronic can be validated, actioned, and archived for real time interrogation.
12. The product test includes an element of independent auditing in a Customer experience manner which is then used to drive continuous improvement activity.
13. In-process and customer results are used to retrain, re-certify/decertify operators as needed.
14. Regular verification against customer reported failures is conducted and action plans tracked for completion (e.g., Plan Do Check Act).
15. Oracle customer data is available to the supplier and the supplier’s employees and is used to drive regular continuous improvement activities (Oracle engineer will supply data feeds where automated delivery or direct access is not available on at least a weekly basis).
16. Vendor has a mechanism in place to monitor and eliminate re-testing where no corrective action has been taken; failures due to test infrastructure issues are not counted.
17. Vendor monitors and retires units which have repeatedly failed and been through the FA process without success.
18. Vendor analyzes test coverage and quality data to drive test optimization and enhancement in line with Product needs.
19. Vendor has a mechanism by which the ability of the test process to fail “BAD” product is regularly validated.

Minimal Acceptable Practice:

1. The product test validates that the product is assembled to the current BOM. The test should include tests for over and under consumption of material (e.g., ensure no extra, nor missing memory devices).
2. The product test should ensure that no design guidelines are violated.
3. The product test validates the functionality of selected user accessible features of the product. This includes, but is not limited to, Drive ejection and insertion, Button and LED actuation and validation and interface connections (Selection to be agreed by Oracle WWOPs engineer).
4. The product test covers all the individual working segments of the product with identification of areas which Pass/Fail.
5. The product test includes at a minimum soft power cycling.
6. The product test includes a formal mechanism by which yields are monitored and failures to a pre-determined goal are highlighted and actioned with the previous tier supplier.
7. The product test includes a mechanism by which repeated failures for common cause result in a suspension of manufacturing until a corrective action is in place.
8. The product test includes an automated limit on the amount of failures and the aging of failures which can be “open” against a process.
9. The product test includes a limit on the amount of failures and the aging of failures which can be “open” against a process.
10. The product test includes a mechanism by which all result data, manual and electronic can be recovered and archived
11. The product test includes an element of Post Pack Auditing which is used to validate outgoing quality levels.
12. In-process and customer results are used to retrain, re-certify/decertify operators as needed.
13. Regular validation of effectiveness to reported customer failures is conducted and action plans tracked for completion (e.g., Plan Do Check Act).

14. Oracle customer data is available to the supplier and the supplier's employees and is used to drive quarterly continuous improvement activities.

15. Vendor monitors and eliminates re-testing where no corrective action has been taken; failures due to test infrastructure issues are not counted.

16. Vendor monitors and retires units that have repeatedly failed and been through the FA process without success.

Unacceptable Practice:

One or more of Minimal Acceptable Practice on Page 34 are not followed.

4.9.3 Product Reliability Test

NOTE 2: Examples of Product Reliability Tests include On-going Reliability Testing (ORT) and Reliability Qualification Testing (RQT).

Best Practice:

1. The Product Reliability Test validates the longer term reliability of the product in a customer environment and runs a mix of customer and baseline test mechanisms.

2. The Product Reliability Test measures POH and reports to goal on a continuous basis.

3. The Product Reliability Test includes a mix of standard and special build to order configurations which track customer order profiles.

4. The Product Reliability Test includes power cycling (Soft and Hard), Multiple OS loads and user accessible features in an attempt to monitor the true customer experience.

5. The Product Reliability Test failures are fast tracked with regular communication and tracking via an Oracle tracking tool (CPAS/PITT, etc.).

6. The Product Reliability Test is designed in a manner which allows normal operator staff members to complete tasks.

7. The Product Reliability Test includes an automated mechanism by which repeated failures for common cause result in a suspension of manufacturing until a corrective action is in place.

8. The Product Reliability Test includes an automated mechanism by which all result data, manual and electronic, can be validated, actioned, and archived for real time interrogation.
9. Regular verification against customer reported failures is conducted and action plans tracked for completion (e.g., Plan Do Check Act).
10. Oracle customer data is available to the supplier and the supplier's employees and is used to drive regular continuous improvement activities.
11. All Product Reliability Test units are cleaned and returned to the standard process for testing.
12. Back-up power is available and used so that test data is not lost during power failures.

Minimal Acceptable Practice:

1. The Product Reliability Test validates the longer term reliability by running repeated diagnostic packages.
2. The Product Reliability Test measures POH and reports to goal on a regular basis.
3. The Product Reliability Test includes manual power cycling in line with normal product usage expectations.
4. The Product Reliability Test includes a mix of Standard configurations.
5. The Product Reliability Test failures are fast tracked with regular communication and tracking via an Oracle tracking tool (CPAS/PITT, etc.).
6. The Product Reliability Test includes a mechanism by which repeated failures for common cause result in a suspension of manufacturing until a corrective action is in place.
7. The Product Reliability Test includes a mechanism by which all result data, manual and electronic, can be recovered and archived.
8. Oracle customer data is available to the supplier and the supplier's employees and used to drive regular continuous improvement activities.
9. All Product Reliability Test units are cleaned and returned to the standard process for testing.

10. Back-up power is available and used so that test data is not lost during power failures.

Unacceptable Practice:

One or more of Minimal Acceptable Practice on Page 36 are not followed.

4.9.4 Audit Test

NOTE 3: An example of an Audit Test is Post Pack Audit (PPA).

Best Practice:

1. The Audit test validates the customer experience by subjecting a random sample of the finished and packaged assembled units to a series of tests and checks which mimic a true customer usability experience.
2. The Audit test is performed in an environment conducive to detecting all items which a customer could identify as a reject. The test is conducted in an area with sound proofing, correct illumination, and detached but close to the manufacturing area. The area is clearly marked.
3. The Audit test measures functional and non-functional aspects to the PRODUCT specification, including all accessory kits and paperwork which would accompany the unit.
4. The Audit test is performed on a random mix of standard and special build to order configurations.
5. The Audit test includes power cycling (Soft and Hard), OS loads, and validation of user accessible features in an attempt to monitor the true customer experience.
6. The Audit test failures are fast tracked with real time feedback to the manufacturing staff and immediate corrective action deployed upstream in the process.
7. The Audit test results are recorded and archived for later interrogation. Pass and Failure logs and inspection records are electronically stored.
8. The Audit test should be subject to some form of validation on a regular basis (e.g., Gage R&R).

9. Oracle customer data is available to the supplier and the supplier's employees and is used to drive regular continuous improvement activities.

Minimal Acceptable Practice:

1. The Audit test validates the customer experience by subjecting a sample of the completed assembled units to a series of tests and checks which closely mimic a customer usability experience.
2. The Audit test is performed in a separate clearly marked area close to the manufacturing area.
3. The Audit test measures functional and non-functional aspects to a generally acceptable level including the presence of all parts contained on the BOM.
4. The Audit test is performed on a mix of standard and special build to order configurations.
5. The Audit test includes a series of tests which complement the manufacturing test process.
6. The Audit test failures are recorded and used to drive corrective action, including increasing the Audit frequency to contain the risk of escapes.
7. The Audit test results are recorded and can be referenced at a later date.
8. The Audit test is reviewed regularly.
9. Oracle customer data is available to the supplier and the supplier's employees and is used to drive regular continuous improvement activities.

Unacceptable Practice:

One or more of Minimal Acceptable Practice on Page 38 are not followed.

References:

WWOPS Engineering: Product and Test Data Requirements, 923-3559-xx

WWOPS Systems: Ongoing Reliability Testing (ORT) Policy, 914-1736-xx

4.10 Inspection

NOTE 4: Inspection includes Visual Inspection, Automated optical inspection, and Solder paste inspection.

Best Practice:

1. The supplier uses a change control process that alerts the Visual and AOI inspection steps of any changes in acceptance or rejection criteria.
2. The supplier records and maintains records of all findings and analyzes this quality data on a regular basis to determine if the Visual inspection processes and AOI programs need to be improved or changed.
3. The supplier provides data input portals (scan points) for in-process product tracking, eliminating the possibility of skipping an inspection step.
4. The supplier maintains written global procedures that clearly define:
    a) How requirements for AOI and Visual inspection are identified and optimized
    b) How to utilize the AOI Equipment to the limit of its abilities
    c) How computers and equipment are set up and run in order to meet both Visual and AOI inspection requirements

Visual Inspection

1. The supplier maintains documented global Visual Inspection Instructions that reflect the product's Drawings and BOMs.
2. The supplier provides product specific training for inspectors relevant to the product being inspected (i.e., accept-reject criteria for Solder, cosmetic attributes, welds, hardware, etc.).
3. The supplier provides inspection tools that allow the operators to perform the Visual inspections that meet the inspection criteria (ample illumination, magnifiers, scopes, stamps, labels, bar-code readers, go-no-go Gages, Pin gages, calipers, etc.).
4. The supplier conducts periodic re-certification of Visual Inspection processes to insure accuracy.

Automated Optical Inspection (AOI)

1. Automatic Optical Inspection(AOI) equipment is used to determine that the correct components are placed on a board and that ALL components with polarity markings are placed correctly.
2. The supplier maintains an AOI program library with revision control for all products and performs periodic calibration or Gage R&R of AOI Equipment and processes to maintain accuracy.
3. All AOI data is linked to the board assembly Serial Numbers.
4. The supplier maintains current copies of all AOI software in use.
5. All AOI machines are maintained to a regular schedule. Maintenance records are available.

Solder Paste Inspection

The supplier sets limits/tolerances on solder paste height/volume and tests optically to determine that the limits or tolerances have not been exceeded (initial Tolerances are set no greater than +/- 20%). Processes are in place to analyze any discovered defects and to define cleaning criteria for re-entering the board into the process

Minimal Acceptable Practice:

1. Items 1 through 4 of Best Practice on Page 39 are followed. However the process/data are not necessarily automated, and the procedures are not necessarily global.
2. For Visual inspection items 1 through 4 of Best Practice on Page 39 are followed. However the procedures are not necessarily global and the inspection tools may not necessarily be state of the art tools
3. For Automated Optical Inspection items 1 through 5 of Best Practice on Page 40 are followed. Tolerances are optimized per the equipment, the process, and the chemistry sets used.
4. For Solder Paste Inspection the supplier sets limits/tolerances on solder paste height/volume and tests optically to determine that the limits or tolerances have not been exceeded. Processes are in place to analyze any discovered defects and to define cleaning criteria for re-entering the board into the process

Unacceptable Practice:

One or more of items of Minimal Acceptable Practice on Page 40 are not followed.

Reference:

PCBA Workmanship Standard

4.11 Shop Floor Control

Best Practice:

1. Supplier's process validates serial numbers, lot codes, MAC addresses, and WWNs when scanned in via bar code.
2. For all serialized FRUs, supplier's process collects positional information (connector, slot, U-location, and chassis number), part revisions, serial numbers, Host IDs, MAC addresses, and WWNs.
3. Supplier's process allows a limit to be set on the number of times a unique part or assembly can be re-used in multiple assembly/disassembly loops whether due to failure or canceled work orders.
4. Supplier's process allows a limit to be set on the length of time that a part or assembly can be used or recycled after initial use.
5. Supplier's process allows special instructions, alerts, and notices to be displayed to the operator when the manufactured unit is affected by special processes (process alert), purges, or stop-ships.
6. Supplier's process automatically updates the BOM of fixed configurations to accommodate deviations and recent part changes.
7. Supplier's process prevents use of part or assemblies that have been blacklisted (because of purge, stopship, or qualification status).
8. Supplier's process prevents use of parts or assemblies that have been re-used through multiple assembly and disassembly loops because of canceled orders or no-trouble found during debug or rework.
9. Supplier's process can collect positional information (connector, slot, U-location, and chassis number), part revisions, serial numbers, Host IDs, MAC addresses, and WWNs from units under test.

Minimal Acceptable Practice:

1. Supplier's process validates the correct part numbers and quantities are assembled according to the Bill of Material (BOM).
2. Supplier's process links reference designators to parts on the BOM.
3. Supplier's process collects serial numbers and/or lot codes of assembled assemblies/parts and creates a hierarchical connection.
4. Supplier's process routes the product through an established series of operations/steps and reports current location or status.
5. Supplier's process prevents a manufactured assembly from shipping until all operations and tests have been successfully completed and passed.
6. Supplier's process allows parts or assemblies to be failed and rejected.
7. Supplier's process records part removals, debug, and FA information on all test failures.
8. Supplier's process prevents use of parts or assemblies that have been failed or rejected without having a record of rework or debug resulting in no trouble found.
9. Supplier's process records which operator, machine, or automated system performed each operation or test.
10. Supplier's process restricts operators from performing operations or tests on products or in processes in which they are not trained nor certified.
11. Supplier's process prevents use of duplicate serial numbers for a given part number regardless of dash level.
12. Supplier's process allows revision control of routes, parts, and assemblies (BOMs).

Unacceptable Practice:

One or more of the following conditions exist.

1. Supplier's process allows a manufactured assembly to ship without completion of all operations in the route.
2. Supplier's process allows a manufactured assembly to ship with missing, incorrect, or extra parts.

3. Supplier's process allows a manufactured assembly to ship without collection of serial numbers and lot numbers.
4. Supplier's process allows a manufactured assembly to ship without passing all tests.
5. Supplier's process allows a single operator rights to complete or pass all operations or tests.
6. Supplier's process allows use of a generic login which does not uniquely identify the operators.

4.12 Documentation Control

Best Practice:

1. There is an official documented authorization process and the documents have also been approved by someone other than the author prior to distribution.
2. Routing and delivery of procedures, polices, and other documentation is automated and available via computer terminals on the manufacturing floor or in an office environment.
3. Automated revision control to ensure that only the current version of a document is available. This should be documented in a procedure that clearly states how this is to be controlled to ensure that no old revisions can be used.
4. Changes are initiated and approved electronically (electronic routing and approval).
5. All records that are signed electronically capture the user name, time/date and signature, approval and or rejection.
6. Control for the automated signature and information that cannot be tampered or modified with after approval or rejection.
7. A master Index of all documents is available electronically and on-line. It is global in nature and is maintained and kept current.
8. Provides a centralized Web-based repository that is secure, but at the same time accessible to all authorized users.
9. Electronic security that prevents or detects unauthorized or accidental changes.
10. Obsolete documents are electronically and physically stamped as such.

11. Automated disaster recovery for all documentation that typically has documents backed up and stored on an off-site server
12. Automated access to reports detailing history of all changes, including the time and dates of any changes, who made them, and approvals and rejections.
13. Ultimate disposition (successful or deleted)
14. Each document is assigned a unique ID such as a part number and title.
15. Record retention policies exist for all documents that are active and archived.

Minimal Acceptable Practice:

1. Manual documentation control process that controls quality documentation, procedures, policies, and quality manuals
2. A controlled document distribution process records and monitors the check out and return of all controlled documents.
3. Revision control ensures that only the current version of a document is available. This should be documented in a procedure that clearly states how this is to be controlled to ensure that no old revisions can be used.
4. Master index of all documents is maintained and kept current.
5. Each document is assigned a unique ID such as a part number and title.
6. All new procedures and changes require signature approval prior to implementation and are approved before distribution and they have also been approved by someone other that author prior to distribution.
7. Obsolete documents are stamped as such.
8. Record retention policies exist for all Documents that are active and archived.
9. Disaster recovery plan exists for all documentation which typically includes having documents backed up and stored on an off-site server.
10. Detailed history of all changes, dates of any changes, and who made them, including approvals and or rejections.

Unacceptable Practice:

1. Changes are made without complete review and approval.
2. One or more of the Minimal Acceptable Practices above are not met.

4.13 Defective Inventory Control/Return Process

Best Practice:

1. As soon as material is identified as defective, it is physically segregated from other material to an area clearly marked as containing discrepant material.
2. When possible, all defective parts are identified/tagged with failure notice or similar method to clearly identify part as non-usable.
3. Defective material is moved to an inventory location that makes it unavailable (non-netable) for use in manufacturing.
4. Serialized defective parts are identified as defective in the shop floor control system to prevent usage into assemblies.
5. Processes are in place that ensures that defective material is returned to suppliers on a weekly basis or scrapped within the same time period. Metrics are in place to measure performance and escalation processes exist.
6. Material that is being returned for rework should be packaged to protect the integrity of the material. Original packaging or equivalent is used.
7. The person responsible for disposition should also be identified and notified. Material must be identified with status, repair, return, or scrap within 5 working days of failure.
8. RoHS and non-RoHS material are segregated.

Minimal Acceptable Practice:

1. As soon as material is identified as defective it must be physically segregated from other material to an area clearly marked as containing discrepant material.
2. When possible, each defective part should be identified/tagged with a failure notice or similar method to clearly identify part as non-usable.
3. Defective material must be moved to an inventory location that makes it unavailable (non-netable) for use in manufacturing.

4. Bar-coded parts that are identified as defective will be recorded in the shop floor control system to prevent usage into assemblies.
5. There must be processes in place that ensure that defective material is returned to suppliers at least twice a month.
6. Material must be identified with disposition, repair, return, or scrap within 14 working days of failure.
7. Material that is being returned for rework should be packaged to protect the integrity of the material, and original packaging or equivalent is used.
8. The person responsible for disposition should also be identified and notified. Material must be identified with disposition, repair, return, or scrap within 10 working days of failure.
9. RoHS and non-RoHS material are segregated.

Unacceptable Practice:

1. One or more of Minimal Acceptable Practice on Page 45 are not met.
2. Material aging in excess of 20 days
3. Material status not determined (repair, return or scrap) within 20 days

4.14 ECO/MAL/RAL/PA/Deviations Control

Best Practice:

1. All incoming customer documentation is logged in and date stamped.
2. Written customer change control procedures, which include an automated change control process to support both documents and processes
3. There is an official review and approval of all Customer Engineering Change Controls (ECO) notices, revisions changes, dash level changes, bill of material changes, drawings, schematics, test procedure changes, software changes, etc.
4. Automated revision control ensures that only the current version of customer documentation is available. This should be documented in a procedure that clearly states how this is to be controlled, to ensure that no old revisions can be used.

5. All changes require authorization prior to implementation. Changes are initiated and approved electronically (electronic routing and approval).
6. All records that are signed electronically capture the user name, time/date and signature, approval and or rejection.
7. Control for the automated signature and information that cannot be tampered with or modified after approval or rejection
8. Master Index of all customer documents is available electronically and on-line and is maintained and kept current.
9. Provides a centralized, web-based repository that is secure, but at the same time accessible to all authorized users.
10. Electronic Security that prevents or detects unauthorized or accidental changes
11. Obsolete documents are electronically and physically stamped as such.
12. Automated disaster recovery for all customer documentation that typically has documents backed up and stored at an off-site server location
13. Automated access to reports, detailing history of all changes, that record the time and dates of any changes, who made them and their ultimate disposition (successful or deleted)
14. Record retention policy exists for all customer documents that are active and archived.
15. Automated control of the dash levels that does not allow shipment of product that is below the current shippable dash levels
16. Any change to a document that warrants new training will automatically invoke training task.

Minimal Acceptable Practice:

1. All incoming customer documentation is logged in and date stamped.
2. There is a written customer documentation change control procedure which includes change control process to support both documents and processes.
3. There is an official review and approval of all Customer Engineering Change Controls (ECO) notices, revisions changes, dash level changes, bill of material changes, drawings, schematics, test procedures, software changes, etc.

4. A controlled document distribution process records and monitors the check out and return of all controlled documents.

5. Revision control to ensure that only the current version of a customer's documentation is available. This should be documented in a procedure that clearly states how this is to be controlled, to ensure that no old revisions can be used.

6. All changes require authorization prior to implementation. Changes are initiated and approved.

7. All records that are signed capture the user name, time/date and signature, approval and or rejection.

8. Master index of all documents is maintained and kept current.

9. Obsolete documents are stamped as such.

10. Record retention policy exists for all customer documents that are active and archived.

11. Disaster recovery plan exist for all customer documentation that typically has the documents backed up and stored at an off-site server.

12. Detailed history of all changes, dates of any changes, and who made them. Includes approvals and or rejections.

Unacceptable Practice:

1. Changes are made without complete review and approval.

2. One or more of the Minimal Acceptable Practice on Page 47 are not met.

4.15 Traceability

Goal:

Provide the infrastructure and the information to trace components, replaceable assemblies, and systems by serial number and/or date/lot code. Traceability is provided from the component up to the system level and from the system level down to the component level. Traceability data is uploaded to Oracle. Traceability data is deemed to be a quality record and is subject to the retention period defined in the Quality Exhibit.

Definitions:

Part: A system replaceable assembly or a component

Component: The building blocks of assemblies – fabricated boards, resistors, capacitors, processors, DIMMs, ASICs, and connectors

Replaceable Assembly (RA): A part that can be added to or removed from a system. This includes FRUs and CRUs.

Electronically Active: Any part that contains electronic components

Critical Part: A part that requires specific traceability information because it can affect product quality

FRUID: Traceability data captured and maintained in an electronically active replaceable assembly

Best Practice:

Part Identification and Labeling:

1. Part numbers and serial numbers are provided on all top-level assemblies and all subassemblies that contain active electronic components (e.g., PCBAs, DIMMS (for Oracle products where DIMM serialization is required), disk drives, power supplies, display devices, processors).
2. All Oracle part numbers and serial numbers are human readable and scannable from the bar code.
3. All non-serialized electronic components (e.g., capacitors, resistors, non-serialized DIMMS) are identified by date/lot code. Where possible, part numbers and date/lot codes are human readable and are provided in a bar code on the component. For small SMT parts, the part number and the lot/date code are on the reel. For other small parts, the part number and the lot/date code are on the box.
4. All passive electrical assemblies (cables, chassis, panels, bezels, etc) are labeled with the Oracle part number and the date/lot code.
5. All assemblies are labeled with the revision level and applied deviations.
6. Shipping labels conform to EIA-556, ANSI 10.8.1, or EAN-UCC standards.

7. An assembly is not re-serialized at any time during its life. An exception is that serialized FRUs returned to a Repair Vendor (RV) with a damaged/unreadable serial number may be re-serialized.
8. Serial numbers are never duplicated.
9. The supplier records the serial numbers of all scrapped assemblies in a global data base.
10. The serial number of a scrapped assembly is never reused.
11. The supplier requires items 1 through 10 above of all Sub-tier suppliers for assemblies and sub-assemblies of electronically active components and of electronically passive assemblies.

Data capture - Scanning/recording of parts to assemblies, sub-assemblies and systems:

1. The supplier collects Traceability data on all manufactured and repaired assemblies, including packaged FRU's and X-options, in accordance with the specifications and procedures listed in *Table 4-1, Oracle Traceability Reference Documents* on Page 53.
2. All serialized components, subassemblies, and assemblies are scanned in or out of the assembly or subassembly at the time they are added or removed. Serial numbers are never typed in manually.
3. Where dynamic FRUID is supported, all additions, removals, and changes to a part (FRUs and X-options included) are stored in the FRUID of all electronically active replaceable assemblies.
4. The positional (slot) information of all serialized assemblies installed into systems is recorded.
5. The serial number recorded in an assembly's FRUID matches that printed on the label.
6. If multiple MAC addresses or WWNs are assigned to an assembly, both the starting address and quantity of sequential addresses are recorded.
7. The part numbers and serial numbers of all accessories, including keyboards and mice are scanned and reported to the system assembly.

Traceability Data Storage and Maintenance:

1. All supplier traceability data collected is maintained in the supplier's Shop Floor Control System.
2. All product traceability data collected is available electronically for realtime and ad hoc queries by Oracle.
3. The supplier responds to Oracle's request for traceability data within 24 hours for data less than one year old and within 48 hours for data greater than one year old.
4. Manufacturing, repair, and process records are maintained for the longer of following options:
    a) The retention period defined in the Quality Exhibit
    b) The retention period dictated by local law and ordinance
5. Limited traceability information is available to customers via the Internet using a valid MAC address, Host ID, or system serial number.
6. The supplier maintains a global data base accessible by all supplier sites and which contains the traceability data, by serial number, for all Oracle products produced by the supplier

Data communication - Uploading of data to Oracle

1. Traceability data on all systems, FRUs, and X-options shipped is uploaded to ODW daily.
2. Traceability data on all systems, FRUs, and X-options shipped is uploaded to FIR daily.
3. Traceability data on small parts (e.g., transistors and capacitors) is uploaded to Oracle only upon request.

Minimal Acceptable Practice:

Part Identification and Labeling:

Same as Best Practice on Page 49

Data Capture - Scanning/recording of parts to assemblies, sub assemblies and systems:

Same as Best Practice on Page 50

Traceability Data Storage and Maintenance:

1. Items 1 through 4 of Best Practice on Page 51 are followed.
2. The supplier maintains traceability records for a minimum period as required by Oracle policy and records retention schedules.

Data Communication - Uploading of data to Oracle

1. Traceability data on all systems, FRUs, and X-options shipped is uploaded to ODW every 48 hours.
2. Traceability data on all systems, FRUs, and X-options shipped is uploaded to FIR every 48 hours.

Unacceptable Practice:

One or more of the items in Minimal Acceptable Practice on Page 51 are not met.

References:

WWOPS Product Lifecycle and Technology: Manufacturing/Operations Requirements Advanced Quality Planning (AQP) Matrix, 913-3592-xx

Table 4-1, Oracle Traceability Reference Documents on Page 53

Quality Exhibit (contract with Oracle)

Table 4-1, Oracle Traceability Reference Documents

Category	Subcategory	Document Number	Area of Specification
Identification	Host ID	923-3521-xx	Host ID
	Part Number	990-1241-xx	Oracle configured (ATO) part number
	Serial Number and Lot Code	923-3383-xx	Subassembly serial number and lot code
		950-1037-xx	Subassembly serial number
		950-2252-xx	Dual inline memory module (DIMM) and central processing unit (CPU) serial number
	Universal Product Code (UPC)	923-3308-xx	UPC or GTIN per GS1 standard
Labeling and Marking	Direct Product Labeling and Marking	950-4477-xx	Solution, system, and subassembly labeling
		950-1037-xx	Subassembly labeling (superseded by 950-4477-xx)
		950-2252-xx	DIMM and CPU labeling
		923-3550-xx	Article labeling per MIL-STD-130
		914-1730-xx	SPARC CPU marking (etching)
		xxx-xxxx-xx	Individual part drawing or specification
		950-xxxx-xx	Individual part specification
		Deviation,concession, ECO, FCO, process alert, stop ship or purge	Special labeling requirements as described in the individual control documents
	Shipping and Carton Labeling	950-1419-xx	Finished-goods carton labeling
		950-1647-xx	Customer information sheet (CIS)
		917-1335-xx	Raw and bulk material labeling
Data Collection and Submission	Field-Replaceable Unit Identification (FRU ID)	950-3757-xx	Overview
		923-3592-xx	New FTP account
		917-1914-xx	Getting started
		917-1915-xx	Process Tasks
		917-1916-xx	Utilities
		917-1917-xx	FIR data collection
		913-3771-xx	FIR Upload Pre-installation checklist
		913-3217-xx	Glossary of terms
	TRAQ/ Operations Data Warehouse (ODW)	923-3406-xx	Primary requirements
		923-3407-xx	XML data format
		923-3409-xx	Flat-file data format
	Test Data Management System (TDMS)	923-3559-xx	Data requirements

4.16 Software Download

Best Practice:

1. Supplier has an identified SWDL (Software down load) Engineer(s) responsible for receiving and responding to communications from the Oracle SWIE (Software Infrastructure Engineering) Team.
2. Supplier has an identified SWDL Engineer(s) responsible for performing routine testing of new SWDL installation software.
3. Supplier has an identified SWDL Engineer(s) responsible for performing routine priming of new SWDL customer content into the local cache proxy infrastructure.
4. Supplier has an identified SWDL Engineer(s) responsible for second-tier troubleshooting of SWDL issues.
5. Supplier maintains the latest infrastructure software versions as stated in the SWIE Release Notes.
6. Supplier has a functional cache-proxy infrastructure, which adheres to the SWIE specification.
7. Supplier allows SWIE secure remote access to the SWDL infrastructure for critical RCCA investigation on a permanent or as needed basis.
8. Process ensures that an appropriate GPI (General Purpose Interface) command line is compiled and executed to load customer facing SWDL content onto the product.
9. Process ensures that SWDL quality data is being captured in TDMS.
10. Process ensures that SWDL installation log files are retained for troubleshooting.
11. Process ensures that the GPI return value (PASS/FAIL) is evaluated prior to executing any post-SWDL step.
12. Process includes first and second-tier troubleshooting of SWDL FAIL issues prior to escalation to Oracle SWIE.

Minimal Acceptable Practice:

1. Supplier maintains the minimum infrastructure software versions as stated in the SWIE Release Notes.
2. Supplier has a functional cache-proxy infrastructure.
3. Process ensures that an appropriate GPI command line is compiled and executed to load customer facing SWDL content onto the product.
4. Process ensures that SWDL installation log files are retained for troubleshooting.
5. Process ensures that the GPI return value (PASS/FAIL) is evaluated prior to executing any post-SWDL step.
6. Process includes first-tier troubleshooting of SWDL FAIL issues prior to escalation to Oracle SWIE.

Unacceptable Practice:

One or more of items 1 through 6 of Minimal Acceptable Practice above are not followed.

4.17 Firmware Management and Maintenance

Goal:

Manage and maintain firmware such that all Oracle firmware is controlled and released on the applicable products at the supplier site. Ensure that all Oracle systems ship with the latest firmware and that the optimal settings are guaranteed prior to delivery.

Best Practice:

1. Supplier has an identified Engineer(s) responsible for receiving and responding to firmware upgrade requests from Oracle.
2. Supplier has an identified Engineer(s) performing validation of the new firmware release in an off-line environment which duplicates the standard manufacturing test process.
3. Supplier reacts to the request to update Firmware via the Oracle external Bugtraq tool/ECO and measures completion of requests to an agreed SLA (Service Level Agreement).

4. Supplier retains test records to demonstrate process validation compliance of firmware changes per Oracle platform.

5. Supplier test process automatically validates current firmware levels and only upgrades when not at the current level.

6. Supplier has the capability to deploy and validate firmware upgrade process at both the start (e.g., Pre-IST (Initial System Test)) and end (e.g., POST-SFT(System Functional Test)) of the test process in the event that the firmware release is not compatible with the test process as currently deployed.

7. In the event of a POST deployment the supplier maintains an action plan to modify the test process within one time cycle (calendar month) such that the firmware update can be implemented at the start of the process.

8. Supplier test process, via automated log file validation, checks the firmware versions for all parts of the system which are software upgradable (e.g., Sys Firmware, CPLDs).

9. Supplier test process, if required, allows physical hardware reprogramming (e.g., CPLD, FPGA). When required, this MUST be performed prior to final system testing.

10. Supplier test process automatically loads optimal defaults or engineering BU specified settings prior to delivery, unless customer order requires specific settings which are then manually set (Oracle X64 products only).

11. Supplier test process has a mechanism to validate that the firmware to be released has met OS certification guidelines (Oracle X64 products only).

12. Supplier updates the complete software release package rather than individual parts.

Minimal Acceptable Practice:

1. Supplier maintains only a single firmware version by Oracle platform in the production line.

2. Supplier only releases updated firmware based on Bugtraq/ECO trigger.

3. Supplier test process automatically loads optimal defaults or engineering BU specified settings prior to delivery unless customer order requires specific settings which are then manually set (Oracle X64 products only).

4. Supplier updates the complete software release package rather than individual parts.

Unacceptable Practice:

One or more of items 1 through 4 of Minimal Acceptable Practice on Page 56 are not followed.

5 Packaging and Palletization

5.1 Packaging

Definitions:

Customer Packaging: The packaging used to ship Oracle products to Oracle customers

Inter-Plant Packaging: The packaging used to ship Oracle products (including Oracle piece parts and components) between manufacturing sites. This packaging is not received by Oracle customers.

FRU/X-option Packaging: The packaging used to ship FRU/X-options to any destination Oracle Service sites, Oracle customers and to Oracle

Best Practice:

1. The drawings and specifications for Customer and FRU/X-option packaging, including art work, are approved by Oracle prior to being used to ship Oracle products to customers (i.e., prior to the P2 build).
2. Customer and FRU/X-option packaging is designed and qualified using Oracle standards as defined on the AQP or the Supplier Exchange Portal.
3. Inter-plant Packaging is designed, qualified, and tested to Oracle standards available in the on AQP or the Supplier Exchange Portal.
4. A qualification process is in place and is followed for all Inter-plant packaging. Results of the qualification are readily available for review by Oracle prior to first use of the packaging.
5. A comprehensive First Article Process, that verifies conformance to packaging specifications (dimensions, artwork, strength, etc.) is in place and followed for all new and modified packaging (Customer, Inter-plant, and FRU/X-option)

used on Oracle products. Results of the First Article Inspection are readily available for review by Oracle (reference 425-1128-xx).

6. All incoming packaging is sampled and checked for conformance to specification. Results are stored and available electronically within 48 hours.
7. Photographs of defective packaging are taken and stored electronically in a global repository.
8. All new product customer Packaging is sealed, top and bottom, using official Oracle logo tape. Repaired FRUs are sealed with clear tape.
9. All packaging material, including pallets, are handled, stored, and assembled according to Oracle standards and drawings.
10. All customer and FRU/X-option packaging must meet the pass/fail criteria in 425-1016 for new and used packaging acceptability/usability. Inter-plant packaging uses a similar specification or leverages the Oracle guideline.

Minimal Acceptable Practice:

1. The drawings and specifications for Customer and FRU/X-option packaging, including art work, are approved by Oracle prior to being used to ship Oracle products to customers.
2. Customer and FRU/X-option packaging is designed, qualified, and tested using Oracle standards available on AQP or the Supplier Exchange Portal.
3. Inter-packaging is designed and tested to Oracle standards.
4. A qualification process is in place and is followed for all Inter-plant packaging. Results of the qualification may not be available on-line but are available within 24 hours.
5. A comprehensive First Article Process, that verifies conformance to packaging specifications (dimensions, artwork, strength, etc) is in place and followed for all new and modified packaging (Customer, Inter-plant, and FRU/X-option) used on Oracle products. Results of the First Article Inspection may not be immediately available but are available within 24 hours for review by Oracle.
6. All incoming packaging is sampled and checked for conformance to specification. Results may not be stored and available electronically but are available within 24 hours.
7. All Customer Packaging is sealed using official Oracle logo tape.

8. All packaging materials, including pallets, are handled, stored, and assembled according to standards and drawings.

9. All customer and FRU/X-option packaging must use the pass/fail criteria in 425-1016 for new and used packaging acceptability/usability. Inter-plant packaging uses a similar specification or leverages the Oracle guideline.

Unacceptable Practice:

One or more items of Minimal Acceptable Practice on Page 58 are not followed.

References:

Oracle Manufacturing: See WWOPS requirements 425-1138-xx doc at AQP or the supplier portal.

425-1016-xx, *Rejectable New Packaging Material*

425-1017- xx, *Specifications and Rejectable Used Packaged Material*
425-1018- xx, *Rejectable Packaging Graphics*
425-1128- xx, *Procedure for Packaging First Article*

425-1165- xx, *Plastic Packaging Labeling*
425-1184- xx, *Packaging Specification: OEM Development Criteria*
425-1228- xx, *Specification for Packaging Material Identification Marking - China RoHS*

5.2 Palletization

Definitions:

Unitize: Bringing several cartons together to form a single stable load

Palletization Requirements: The practices to be followed when unitizing Oracle products on a pallet

Best Practice:

1. **Pallet Design**

   The pallet shall be a Four Way Entry Notched Stringer Design (See Figure 1 in spec 425-1019-xx).

2. Pallet Loading

a) Carton overhang is never permitted either in the warehouse or in transit (Oracle recommends a 0.5” minimum carton set-back from the pallet edge on all 4 sides).

b) Maximum load height (including pallet) shall be no greater than 54" (1372 mm).

c) Maximum load weight (including pallet) shall be no greater than 2000 lbs. (909.1 kg).

d) Only one (1) Oracle Part Number is permitted on pallets of Oracle products shipping to an Oracle X-dock. Mixed load pallets require prior written approval from the recipient. This requirement does not apply to Oracle products shipping directly to an Oracle customer and Oracle products shipping from a Repair Vendor.

e) Whenever possible column loading carton configuration shall be utilized (See Figure 2 of 425-1019-xx).

f) Cartons shall be positioned on the pallet so that the Part Identification Label on several cartons is visible from the side of the pallet.

3. Pallet Utilization

Stretch wrap, corner guards, plastic banding and edge guards, and pallet top cover (pallet cap or corrugate sheet) are required to palletize in a manner that is compatible with Oracle's product protection, manufacturing, and distribution requirements.

Reference**:** “Order of Assembly” Figure 6, Page 11, 425-1019-xx

4. Pallet Stacking

Pallet load compression strength shall be great enough to allow stacking of pallets (including the pallets) to a maximum of 108"/2742mm (distribution) and 200"/5080mm (warehouse).

5. Pallet Wrapping

The pallet is wrapped with plastic wrap prior to usage to prevent water damage in transit.

Minimal Acceptable Practice:

Items 1 through 4 of Best Practice on Page 59 are followed.

Unacceptable Practice:

One or more of items 1 through 4 of Best Practice on Page 59 are not followed.

References:

Oracle Specification 425-1019-xx, *Palletization Guideline for Inbound/Outbound Shipments*

Oracle Specification 950-1685-xx, for approved banding materials

6 Rework and Repair

6.1 Overall Rework Guidelines

The following table identifies the maximum number of repairs a board or site may receive. Any deviations from this guide require an Oracle and supplier review to determine if board should be scrapped. ***Liability will be determined at this engineering review.*** These rules should be used as a first step in the rework process, prior to the start of rework, to ensure that additional rework cycles will exceed the listed maximums. Ideally, these rules are incorporate into the shopfloor system that automatically locks a board out of the system if limits will be exceeded.

Repair Type	Repair Operation	Max Limit Per Site*	Max Limit Per Board	Points Accumulated each Operation
BGA	Hot air	2	3	10
BGA	Soldering Iron	2	3	10
MICTOR	Hot air	2	3	10
MICTOR	Soldering Iron	1	3	10
PTH DIMM Conn	Solder Pot	2	3	10
PTH DIMM Conn	Other – TBD	2	3	10
PTH DCDC	Solder Pot	2	3	10
20/25/50 mil	Solder Iron	5	5	6
Discretes	Solder Iron	5	As many as req'd	
				Total Pts (30 Max)
VHDM		Max limit per wafer is 2		

* Site = reference designator

NOTE 5: Baking temperatures should not exceed the maximum temperature limits for the components on the board being repaired or 105°C whichever is less. Electro-lytic and electro-chemical capacitors have limitations to high temperature exposures for longer than soldering durations. Where possible, temperature sensitive components should be removed to permit the board to be baked at 100-105°C for 12-24 hours.

Normal Rework: If the point total after the new rework will not exceed 30 points and no site will have been reworked more than two times, engineering review is not required to proceed with the rework.

Engineering Review Required: If the point total after the proposed rework is greater than 30, but will not exceed 60 points and the following conditions are met, an engineering review may allow the proposed board rework:

1 No BGA sites would be reworked more then two times.

2 If the site has been reworked once and there have been no BGA reworks within one BGA width of the proposed site

3 No MICTOR sites reworked more than once

Scrap: If the point total after the new rework will exceed 60 points, the board needs to be scraped or used as capitol equipment, and corrective action is required.

Maximum Rework Limit: Under no conditions (even engineering review) may a single site for BGA's or DIMM connectors be reworked more than two times. A single site for MICTOR connectors may not be reworked more than once.

6.2 General Rework Practices:

Goal:

Repair, remove and/or replace a part consistently and reliably without damaging other components.

6.2.1 Process

Best Practice:

1. The shop floor system implements the rework rules/limits to prevent material from moving forward in the process if rework rules/limits have been exceeded.
2. An Engineering Review Board assesses material that is about to exceed rework rules/limits prior to scrapping the material or allowing it back into the process.
3. The shop floor system records the operator ID of the operator requesting the repair/rework and of the operator performing the repair/rework.
4. The complete repair/rework history of all boards is maintained online. This history includes:
    a) Reference designator or FRU location
    b) Component part

c) Date code/lot code

d) Vendor (not required for Service Repair)

e) Repair performed

5. All operators performing repair/rework, disassembly, and reassembly are properly trained and certified. Training records are maintained and are available online.

6. There is a review process in place that evaluates the success rate of the rework/repair process.

Minimal Acceptable Practice:

1. Items 1 through 5 of Best Practice on Page 63 are followed. However, items 1 and 3 are not necessarily automated in the shop floor system.

2. Maintenance records do not necessarily include 4 c and d on Page 64.

Unacceptable Practice:

One or more of items 1 through 5 of Best Practice on Page 63 are not followed at least manually.

6.2.2 General Repair and Rework - Tooling

Best Practice:

1. Tooling is used that prevents damage to the chassis, system, board, component during the repair/rework process (e.g., a base plate that supports the board and prevents flexing).

2. Shield and part removal tools are available and have been tested to ensure board and connector damage do not occur.

3. All tooling is calibrated and maintained to a regular schedule. Maintenance records are available.

4. All tooling is numbered. Maintenance is tracked to the tool serial number.

Minimal Acceptable Practice:

1. Items 1 and 2 of Best Practice above are followed.

2. Items 3 and 4 of Best Practice on Page 64 are followed. However, maintenance records are not available.

Unacceptable Practice:

One or more of items 1 and 2 of Minimal Acceptable Practice on Page 64 are not followed.

6.2.3 General Repair and Rework - Test and Inspection

Best Practice:

1. Transmissive or X-ray laminography is used to inspect the rework where required.
2. Optical and microscopic devices are available to inspect the rework where required.
3. Drop gauges are used to inspect rework where required.
4. There is a documented visual inspection process for all rework.
5. A functional test is performed to validate the repair/rework where required.

Minimal Acceptable Practice:

1. Although Items 1 through 3 of Best Practice above are not followed, a magnified visual inspection process is followed.
2. There is a visual inspection process but it is not documented.
3. A functional test is performed to validate the repair/rework where required

Unacceptable Practice:

One or more of items 1 through 3 of Minimal Acceptable Practice above are not followed.

References:

WWOPS Process Technology: Printed Circuit Board Assembly Workmanship Standards, 910-1021-xx

WWOPS Sparc Volume Operations: Strain Gage Test Procedure, 914-1739-xx

Printed Wiring Board Strain Gage Test Guideline, IPC/JEDEC-9704

6.3 BGA Repair and Rework

Goal:

Remove and replace a part consistently and reliably without damaging other components.

6.3.1 Process Qualification/Process

Best Practice:

1. Profiles are developed using thermal couples attached with high temp solder or with epoxy inside a solder ball.
2. Profiles are developed for component removal and component replacement using a board with the same thermal mass as the board being reworked.
3. Components with lower maximum temperature limits than the bakeout temperature are identified during the qualification process.
4. Low maximum temperature sensitive components are removed prior to board bakeout.
5. The quality of the qualification rework is validated using x-ray, x-sectioning, and elemental analysis (EDX-energy, SEM – Scanning Electron Microscope).
6. Qualification includes 2 time removal at the same BGA location. X-sectioning has been performed to validate the PCB integrity due to copper dissolution after the second removal.
7. Hot air nozzles are qualified for each BGA to be replaced.
8. A non-contact method (e.g., hot air removal with vacuum assist) has been qualified and is used to prepare the BGA site for rework.
9. BGA rework instructions include:
    a) Instructions on how to check the board rework history
    b) Step by step description of the rework/pre-bake and temperature sensitive component removal process to be followed
    c) PCBA and BGA handling instructions
    d) Definition of the BGA rework machine to be used and its capabilities

e) Definition of the chemical set to be used

f) Definition of the tooling set to be used

g) Definition of the profiles to be used

h) Definition of the shielding to be used

i) A definition of the bakeout time and temperature

j) A definition of the ramp up (.6 – 1.3C per sec.) and ramp down (6C per sec.)

10. The repair history of the board to be reworked is checked to ensure that rework does not exceed allowable limits.

11. All rework operators are trained and qualified on the rework process and have demonstrated proficiency. Training records are up to date and are maintained on line.

12. Oven bakeout time and temp (see *section 6.1*, *Overall Rework Guidelines* on Page 62) is an automated controlled process.

13. The site uses on-line tracking of of all boards while in repair.

Minimal Acceptable Practice:

1. Items 1 through 7 of Best Practice on Page 66 are followed.

2. A contact method (e.g., using qualified soldering iron and tips and copper braiding) has been qualified to prepare the site for component replacement.

3. Item 9, BGA rework Instructions, of Best Practice on Page 66 is followed.

4. The repair history of the board to be reworked is checked to ensure that rework does not exceed allowable limits.

5. All rework operators are trained and qualified on the rework process and have demonstrated proficiency. Training records are up to date but are maintained using a manual process.

6. Bakeout time/ramp and temp (see *section 6.1, Overall Rework Guidelines* on Page 62) is not necessarily an automated process. However, it is a controlled process.

7. The site uses a manual method to track all boards while in repair.

Unacceptable Practice:

One or more of items 1 through 7 of Minimal Acceptable Practice on Page 67 are not followed.

6.3.2 BGA Repair and Rework – Tooling

Best Practice:

1. Shielding is used to protect all temperature sensitive components.
2. Carriers are used to protect the board from damage.
3. The BGA rework machine has automated removal and replacement.
4. The BGA rework machine includes a mirror/optical system to facilitate alignment.
5. The BGA rework machine has heating and cooling controls to sustain board and component temperature requirements.
6. Thermal couples are used during BGA rework to ensure board and component temperatures stay within required temperature ranges.

Minimal Acceptable Practice:

1. Items 1 and 2 of Best Practice above are followed.
2. The BGA rework machine is not automated. However, the site has a demonstrated proficiency in BGA rework.
3. The BGA rework machine does not include a mirror/optical system for alignment. However, the BGA operators have demonstrated a proficiency in alignment.
4. Items 5 and 6 of Best Practice above are followed.

Unacceptable Practice:

One or more of items 1 through 4 of Minimal Acceptable Practice above are not followed.

6.3.3 BGA Repair and Rework – Test and Inspection

Best Practice:

1. BGA rework is inspected to the criteria defined in IPC-A-610 Acceptability of Electronic Assemblies.
2. Transmissive or X-ray laminography is used to inspect the rework.
3. A borescope of some kind is used to inspect the rework areas.
4. A BGA mini mirror is available to inspect the rework.

Minimal Acceptable Practice:

1. BGA rework is inspected to the criteria defined in IPC-A-610 Acceptability of Electronic Assemblies.
2. Item 2 of Best Practice above is followed.
3. A borescope is not necessarily available to inspect the rework; however, other optical devices (e.g., Microscope) are available to inspect the rework.
4. A BGA mini-mirror is available to inspect the rework.

Unacceptable Practice:

One or more of items 1 through 4 of Minimal Acceptable Practice above are not followed.

References:

IPC-7711 *Rework of Electronic Assemblies*
IPC-7721 *Repair and Modification of Printed Circuit Boards and Electronic Assemblies*

WWOPS Process Technology: Printed Circuit Board Assembly Workmanship Standards, 910-1021-xx

WWOPS Sparc Volume Operations: Strain Gage Test Procedure, 914-1739-xx

IPC/JEDEC-9704, *Printed Wiring Board Strain Gage Test Guideline*

IPC-A-610, *Acceptability of Electronic Assemblies*

7 Failure Analysis and Debug

Definitions:

Product – Sub-assemblies, PCBA, full systems or solutions

Testing – Electronic, Software, Mechanical or physical testing

Best Practice:

1. The individuals or groups completing the analysis meet all of the training and certification needs of the Product sets being tested.
2. The Product is tested in a manner that recreates both the manufacturing validation process, which the product would have encountered based on its date of manufacture, and any customer validation, which is perceived or documented in the return material.
3. The Product is not updated or reworked before an identified causal is detected which explains the original failure mode.
4. If the Product has a time to failure element, both the failure reproduction (debug) and corrective action validation in FA should be exercised to failure or to three times the reported TTF in the event the issue cannot be recreated. For Oracle products with TTFs greater than 20 hours this may be 2-3 times the reported TTF and may include additional off-line testing.
5. The product test is segmented such that the targeted failing element can be validated precisely. Prior to return to the manufacturing area, the Product is subjected to one complete system test run to ensure high predictability of success.
6. The Product is electronically tagged as a failure and is controlled while in the failure analysis area via a shop floor tracking system. The system prevents recycling of the material until a valid failure diagnosis or thorough evaluation is completed.
7. The failure and subsequent repairs carried out on the Product as a result of the analysis are recorded in the permanent record electronically and remotely searchable by Product serial number.

8. The Product cannot be returned to good stock if cycled through the failure analysis process three times or more (including NTFs) without being approved through an MRB process.
9. The identification of 'Repeat' failure modes is automatically flagged or escalated to allow preventative action to be taken. Line stop, lot rejection, etc., require supervisor action to overrule activity. Supervisor actions are recorded accurately.
10. The Test methods used are qualified, approved and legally available for use for the purpose of diagnosing the platform.
11. Failure analysis results are used to retrain, re-certify/decertify operators as needed.
12. Failure histories and repair records are maintained through end of Product Service life.
13. Maximum WIP levels in FA are set, and if exceeded, RCCA is implemented.
14. Evidence exists that FA WIP levels and results are compared across suppliers sites.

Minimal Acceptable Practice:

1. The individuals or groups completing the Failure analysis meet the minimum training and certification needs of the product being tested.
2. The Product is tested in a manner which recreates the manufacturing validation process which the product would have encountered based on its date of manufacture.
3. The Product is not updated or reworked before an identified causal is detected which explains the original failure mode. This does not necessarily apply to repair vendors.
4. If the Product has a time to failure element, both the failure reproduction (debug) and corrective action validation in FA should be exercised to failure or to three times the reported TTF in the event the issue cannot be recreated. For Oracle products with TTFs greater than 20 hours this may be 2-3 times the reported TTF and may include additional off-line testing.
5. The product test is segmented such that the targeted failing element can be validated precisely.

6. The Product is adequately identified as a failure and is logged into the failure analysis area.
7. The failure and subsequent repairs carried out on the Product as a result of the analysis are recorded in the permanent record searchable by Product serial number.
8. The Product cannot be returned to good stock if cycled through the failure analysis process three times or more without being approved through an MRB process.
9. The identification of 'Repeat' failure modes is flagged or escalated to allow preventative action to be taken (Line stop, lot rejection, etc.).
10. The Test methods used are qualified, approved, and legally available for use for the purpose of diagnosing the platform.
11. Failure analysis results are used to retrain, re-certify/decertify operators as needed.
12. Failure histories and repair records are maintained in line with contractual obligations.

Unacceptable Practice:

One or more items of Minimal Acceptable Practice on Page 71 are not followed.

8 Site Quality

8.1 Internal Audits

Best Practice:

1. The site has a comprehensive, well documented internal audit process which includes auditing to established corporate global best practices.
2. Internal audits are conducted at least semi annually with documented results and action items.
3. A responsible owner is assigned for each problem/issue.
4. Corrective actions are developed and implemented for each issue.
5. Corrective actions are reviewed for applicability to all other Oracle products processed at the site and at the global sites.

6. Audit results are shared and reviewed with the site management team.

Minimal Acceptable Practice:

1. The site has a comprehensive, well documented internal audit process.
2. Although, the site does not completely conform to items 2 through 6 of Best Practice, it has a documented plan with milestones and is actively working to full compliance to items 2 through 6 of Best Practice on Page 72.

Unacceptable Practice:

1. The site does not have a comprehensive, well documented internal audit process.
2. The site does not conform to one or more of items 2 through 5 of Best Practice on Page 72.

8.1.1 Third Party Audits (site certifications)

Best Practice:

1. The site is ISO 9001:2000 certified.
2. The site is certified to other standards as required by their contract with Oracle.
3. The site is audited, at least annually, by a third party to verify continued certification to ISO 9001:2000.

Minimal Acceptable Practice:

1. The site is not yet ISO 9001:2000 certified but has an active program, with milestones, to achieve ISO 9001:2000 certification.
2. The site is certified to other standards as required by their contract with Oracle.

Unacceptable Practice:

1. The site is not ISO 9001:2000 certified and is not working toward ISO certification.
2. The site has been ISO 9001:2000 certified but has not maintained ISO 9001:2000 certification.
3. The site is not certified to other standards as required by their contract with Oracle.

8.2 Cleanliness and Organization

Best Practice:

1. The site has written procedures and check lists that define the cleaning procedures to be followed and their frequency.
2. Housekeeping
   a) Floors are kept clean and free of debris.
   b) Floors are swept and cleaned on a regular schedule.
   c) Waste receptacles are located convenient (within arm's reach) to operators.
3. Workplace organization
   a) The workplace is organized, clean and free of extraneous tools and parts.
   b) There is a designated place for all tools required to perform the operation at the workplace.
   c) All parts are clearly labeled and/or are in bins that are clearly labeled.
   d) Each bin or box at the workplace contains a single part number only.
   e) Only parts and tools required for the operation are on or at the workplace.
   f) The workplace is cleaned and organized at the end of each work shift.
4. Workplace cleanup and cleanliness: The workplace is organized, dust removed (e.g., Vacuumed), and cleaned on a regular schedule.
5. All carts and carriers are clearly labeled to indicated the status (e.g., “On hold for FA”, “Waiting for system test”) of the contents.
6. All material on the floor is clearly labeled - part number and intended usage.
7. Material is segregated, where required, to avoid the possibility of misuse.
8. All debris is disposed of properly in an environmentally friendly manner.
9. There is documented evidence that items 2 through 4 above are performed on a regular basis.

Minimal Acceptable Practice:

1. Items 2 through 8 of Best Practice on Page 74 are followed.
2. The site may not have written procedures and/or may not have evidence that items 2 through 4 of Best Practice on Page 74 are performed on a regular basis.
3. Debris is disposed of properly. However, it is not necessarily disposed of in an environmentally friendly manner.

Unacceptable Practice:

One or more of items 2 through 8 of Best Practice on Page 74 are not followed.

8.3 Environmental Control

Goal:

Provide the temperature, humidity, and particulate count controls to ensure that Oracle boards and systems are not exposed to conditions that could compromise their integrity and performance and to ensure that they only operate within their specified temperature and humidity ranges.

8.3.1 Temperature and Humidity

Best Practice:

1. The supplier has a documented environmental policy that defines the process for temperature, humidity, and particulate monitoring and control.
2. The supplier's documented environmental policy accommodates final product requirements as well as component level requirements.
3. The supplier's documented environmental policy meets human safety requirements as well as environmental requirements for chemicals, electronic, non-electronic materials, and systems.
4. Real-time controls are in place to take immediate action to bring out-of-bound conditions within acceptable levels and to notify Oracle of the out-of-bound conditions. These controls include alerting responsible parties of an out-of-bound condition.
5. The supplier's documented environmental policy includes the immediate action to take to bring out-of-bound temperature and humidity within the required limits and notification to Oracle of out-of-bound condition.

6. The supplier's environmental policy is designed to minimize/eliminate boundary conditions or out-of-bound conditions (e.g., taking extra precautions such as more frequent measurements, stopping a heat generating activity, or preventing material from proceeding to next operation or destination).
7. Systems are in place to provide traceability to materials experiencing the out-of-bound conditions.

Minimal Acceptable Practice:

1. The supplier has a documented environmental policy that defines the process for temperature and humidity monitoring and control.
2. The supplier's documented environmental policy accommodates final product requirements as well as component level requirements.
3. The supplier's documented environmental policy meets human safety requirements as well as environmental requirements for chemicals, electronic, non-electronic materials, and systems.
4. Controls are in place to take immediate action to bring out of bound conditions within acceptable levels and to notify Oracle of the out-of-bound conditions. These controls include alerting responsible parties of an out-of-bound conditions.
5. The supplier's documented environmental policy includes the immediate action to take to bring out-of-bounds temperature and humidity within the required limits and notification to Oracle of out-of-bound conditions.
6. The supplier's environmental policy is designed to minimize/eliminate boundary conditions or out-of-bounds conditions (e.g., taking extra precautions such as more frequent measurements, stopping a heat generating activity, adding air conditioning or humidity, or preventing material from proceeding to next operation or destination).
7. Systems are in place to provide traceability to materials experiencing the out-of-bounds conditions.

Unacceptable Practice:

One or more of items 1 through 7 of the Minimal Acceptable Practice above are not followed.

8.3.2 Particulate Count

Best Practice:

1. The site measures particle size 0.3 microns and larger, 0.5 microns and larger, and 5.0 microns and larger.

2. The site policy is to maintain particle counts of 60% or lower of ISO 14644 class 8 for SMT, board build areas, system assembly, test areas, 80% or lower of ISO 14644 class 8 for system assembly, test areas, and any other areas where Oracle components, boards, or systems are exposed.

3. Particulate count is measured by trained site personnel (or a licensed contractor) with calibrated equipment daily at multiple sites throughout the factory. Records are maintained and are available. Once levels have been maintained within 60%/80% of limits for 2 months, measurements are taken weekly.

4. Locations where particulate count is measured include incoming inspection areas where boards and electronic components are inspected, the locations where Oracle products are assembled and tested (including ORT and RQT), locations where Oracle CPU attach is performed, SMT locations where Oracle boards are produced, rooms where Oracle systems are packaged, and entrances and exits to the rooms where these activities occur.

5. When particle counts are above 60%/80% of the ISO 14644 class limits, the site changes to daily testing and instigates corrective action to lower the particulate counts. Daily testing continues until the site has maintained 4 consecutive weeks of readings below 60% of the limits.

6. The site has written procedures to be implemented when particle counts exceed the 60% of the ISO 14644 class limit. Records are maintained of procedure executed and date and time of execution.

7. All entrances to the manufacturing floor where Oracle boards and systems are manufactured and tested are protected from external sources of particulate count and debris.

8. Whenever construction work is performed in the buildings where Oracle boards and systems are tested and manufactured, Oracle products and the air filtration systems supporting them are protected from the construction debris.

9. The filters used to control particle count are cleaned and/or replaced to a manufacturer's recommended schedule. Records are maintained and are available.

Minimal Acceptable Practice:

1. The site measures particle size 0.5 microns and larger **and** 5.0 microns and larger.
2. The site policy is to maintain particle counts within the limits of a documented standard that has been shown to protect computer components and systems from compromise (both cosmetic and functional) due to particulate exposure. This standard has limits for both 0.5 microns and greater and 5 microns and greater.
3. Particulate count is measured by trained site personnel (or a licensed contractor) at least weekly at multiple sites throughout the factory. Records are maintained and are available.
4. Locations where particulate count is measured include some but not necessarily all of the following:
    a) Incoming inspection areas where boards and electronic components are exposed
    b) System assembly and test (including ORT and RQT)
    c) Oracle CPU attach (under laminar flow hood if used)
    d) SMT locations
    e) Board build location(s)
    f) Packaging
    g) Entrances and exits to the rooms where Oracle activities occur
5. The site has procedures to be implemented when particle counts exceed the limits of the documented standard. Records are maintained of procedure executed and date and time of execution.
6. All entrances to the manufacturing floor where Oracle boards and systems are manufactured and tested can be but are not always protected from external sources of particulate count and debris.
7. Whenever construction work is performed in the buildings where Oracle boards and systems are tested and manufactured, Oracle products and the air filtration systems supporting them are protected from the construction debris.

8. The filters used to control particle count are cleaned and/or replaced to a manufacturer's recommended schedule. Records are maintained and are available.

Unacceptable Practice:

One or more of items 1 through 8 of Minimal Acceptable Practice on Page 78 are not followed.

References:

ISO 14644 Clean room standards

9 Preventive Maintenance and Calibration

Best Practice:

1. All tools, work benches, and equipment are maintained and/or calibrated on a regular schedule but not to exceed one year. Maintains the accuracy and requirement of the original manufacturer specification. Maintenance/calibration frequencies are adjusted to maintain the accuracy and requirement of the original manufacturer specification
2. All tools, work benches, and equipment are individually marked with the latest and next PM/calibration date.
3. Automated calibration notification, escalation notices, recall, and record keeping
4. Preventive Maintenance and Calibration procedures are clearly defined and written for each instrument and support equipment. Maintenance activities are documented.
5. When a new piece of test equipment (tools, fixtures, etc.) is brought onto the shop floor, the equipment owner informs the preventative maintenance coordinator so that the preventive maintenance data base can be updated.
6. Equipment requiring calibration includes, but is not limited to, the following: meters, torque drivers, any test equipment, tooling or production equipment with measurement accuracy which may affect product quality.
7. Process for segregating and or retiring Obsolete, Out-of-Calibration, Damaged, or Inactive Equipment

Minimal Acceptable Practice:

1. All tools, work benches, and equipment are maintained and/or calibrated on a regular schedule but not to exceed one year and that maintains the accuracy and requirement of the original manufacturer specification.
2. All tools, work benches, and equipment are NOT individually marked with the latest and next PM/calibration date, but there is evidence/records that the PM/calibration has been performed on schedule.
3. Processes exist for calibration notification, escalation notices, recall, and record keeping.
4. Preventive Maintenance and Calibration procedures are clearly defined and written for each instrument and support equipment. Maintenance activities are documented.
5. When a new piece of test equipment (tools, fixtures, etc.) is brought onto the shop floor, the equipment the owner informs the preventative maintenance coordinator.
6. Equipment requiring calibration includes, but is not limited to, the following: Meters, Torque drivers, any test equipment, or production equipment with measurement accuracy that may affect product quality.
7. Process for Damaged or Inactive Equipment

Unacceptable Practice:

One or more of items 1 through 3 of Minimal Acceptable Practice on Page 80 do not exist.

9.1 ESD Controls

Best Practice:

1. The American National Standards Institute (ANSI)/ESDS20.20 standard is complied with.
2. The site has a written ESD control plan.
3. The site provides and tracks ESD training of all employees.
4. The site has a designated ESD manager for each functional area.

5. The site conducts compliance checks to the ANSI/ESD standard every 90 days or more frequently as required to demonstrate that continuous ESD compliance is maintained for all workstations, carts, and fixtures.
6. All ESD mats and work surfaces are maintained in good condition. The supplier has defined criteria (e.g., cracks and tears in the mat or work surface that when met require replacement of the mat or work surface).
7. Records are maintained for all ESD checks.
8. All persons, without exception, entering the factory must wear an ESD smock and ESD heel straps or ESD safe footwear on both feet.
9. ESD smocks comply with ANSI/ESD S20/20.
10. Each foot is checked for ESD compliance upon each entry to the factory floor. Persons who do not pass this check are not permitted on the factory floor
11. All employees have current ESD certification status on their badge.
12. Product areas are free from non-compliant materials (e.g., packaging materials). The entire factory (or repair center) floor is an ESD safe area per ANSI/ESD S20.20.
13. All operations that can be performed in a seated position (i.e., a chair is available or is usually available) are performed with a grounded ESD wrist strap or an ESD grounded chair.
14. The primary ESD protection is functionally tested, with audible feedback, at the place the operation is performed.
15. All static safe work surfaces have a resistively to ground between 1X106 Ohms (1 Mega ohm) and 1X109 (1 Gig ohm).
16. Use of turnstile gates.

Minimal Acceptable Practice:

1. The ANSI/ESD S20.20 standard is complied with.
2. The site has a written ESD control plan.
3. The site provides and tracks ESD training of all employees.

4. The site conducts compliance checks to the ANSI/ESD standard every 90 days or more frequently as required to demonstrate that continuous ESD compliance is maintained for all workstations, carts, and fixtures.
5. All ESD mats and work surfaces are maintained in good condition.
6. Records are maintained for all ESD checks.
7. ESD smocks are worn by all employees and all visitors to ESD safe areas.
8. ESD smocks comply with ANSI/ESD S20.20.
9. All operations where ESD damage (immediate or latent) could occur are performed within ESD safe areas. This includes packout but excludes PPA.
10. All operations that can be performed in a seated position (i.e., a chair is available or is usually available) are performed with a connected ESD wrist strap.
11. All employees and visitors to ESD safe areas wear ESD heel straps or ESD safe footwear on both feet.
12. Each person entering an ESD safe area is checked for ESD compliance. Persons who do not pass this check are not permitted in an ESD safe area.
13. All ESD safe areas are clearly marked
14. Measures are taken to ensure that persons without ESD smocks and/or without heel straps on each foot or ESD safe shoes are kept at a distance of greater than 1 foot from all unprotected (ESD) system components.

Unacceptable Practice:

One or more of items 1 through 14 of Minimal Acceptable Practice on Page 81 are not followed.

References:

ANSI/ESD S20.20 standard

ESD TR53 - ESD Technical Report53

IEC 61340-5-1, *Protection of Electronic Devices from Electrostatic Phenomena – General Requirements*

100015-1, *Basic Specification: Protection of Electrostatic Devices - Part 1 General Requirements*

9.2 Record Retention

Best Practice:

1. All inspection, Test and Quality records, and documentation for Products and Components referenced and indicated in the agreed Quality Exhibit, shall be retained by the supplier for a period of not less than that detailed in the applicable Quality Exhibit or as designated by local country regulations (if longer).
2. The supplier has a specified retrieval process via Service Level Agreement (SLA) and measurement processes to ensure maintenance of that process. This may include more rapid recovery (hours rather than days) for a more recent and shorter period of time.
3. The supplier has a process for an eco-friendly and effective disposal of records after they exceed Oracle's requirements and only after pre-approval is gained from Oracle.
4. The supplier maintains a global list of titles by Oracle product of what are deemed to be quality records (for example, Hipot, Test Logs, Maintenance records).

Minimal Acceptable Practice:

1. All inspection, Test and Quality records, and documentation for Products and Components referenced and indicated in the agreed Quality Exhibit, shall be retained by the supplier for a period of not less than that detailed in the applicable contracts/master agreements. These agreements will specify each minimum time period by record designator unless otherwise required in the specific product specification/SOW or as designated by local country regulations (if higher).
2. Supplier maintains a list of titles, by product, of what are deemed to be quality records (for example, Hipot, Test Logs, Maintenance records).

Unacceptable Practice:

One or more of Minimal Acceptable Practice on Page 83 are not followed.

9.3 Sharing and Global Alignment

Best Practice:

1. The EM/RV shares and drives commonality in practice across all sites. Commonality of practice is driven in the areas of warehouse practices, manufacturing processes, repair processes, test processes, tooling, fixturing, data capture, and traceability.
2. There is a global team with cross site responsibility and authority.
3. Regular (at least once per month) global alignment meetings are conducted and are attended by all sites.
4. Evidence of effective cross-site communication exists. For example, minutes exist from global site meetings that clearly define action items and track progress.
5. Sites are audited (at least twice per year) by non-local, global alignment team members for adherence to global standards.
6. Warehouse practices, manufacturing processes, repair processes, test processes, tooling, fixturing, data capture, and traceability are closely aligned across global sites.
7. Differences in practice between sites are documented per Oracle product.
8. Product alignment meetings are conducted and are attended by all sites. The meetings are documented and action items are tracked.
9. Practices are closely aligned for all sites handling a particular Oracle product.

Minimal Acceptable Practice:

1. The EM/RV shares and drives commonality in practice across all sites. Commonality of practice is driven in the areas of warehouse practices, manufacturing processes, repair processes, test processes, tooling, fixturing, data capture, and traceability.
2. There is a global team with cross site responsibility and authority.
3. Regular (at least once per quarter) global alignment meetings are conducted and are attended by all sites.

4. Evidence of effective cross site communication exists. For example, minutes exist from global site meetings that clearly define action items and track progress.
5. Sites are audited (at least annually) by non-local, global alignment team members for adherence to global standards.
6. Warehouse practices, manufacturing processes, repair processes, test processes, tooling, fixturing, data capture, and traceability are not yet closely aligned across global sites, but there is an active program to achieve alignment.
7. Differences in practice between sites are documented per Oracle product.
8. Product alignment meetings are conducted and are attended by all sites. The meetings are documented and action items are tracked.
9. Practices are not yet closely aligned for all sites handling a particular Oracle product. However, there is an active program, with a timeline, to achieve alignment.

Unacceptable Practice:

One or more of items 1 through 9 of Minimal Acceptable Practice on Page 84 are not followed.

9.4 Training / Certification

Best Practice:

1. The site has an online system that:
    a) Defines each training class and its expiration.
    b) Defines the training/certification requirements for each job category and assembly step.
    c) Tracks the current training levels and certification of each employee, including engineers and managers.
    d) Tracks certification expiration and notifies the employee and the employee's manager prior to the expiration.
    e) Allows employees and managers to be sorted by job category (i.e., which employees are certified to perform specific jobs).

f) The data in the online system is current within 24 hours.

2. Employees are required to pass a test for each course taken. Records are maintained of the employees test performance. Test performance is considered in the employee's performance appraisal.

3. The online system validates an operator's training/certification as the operator signs in to perform the task, and it prevents an operator with expired training from performing the task.

4. Each employee's badge includes a record of their current certification and training.

5. There is a base set of training that is required for all employees who enter the production floor.

6. The site has an effective process for receiving and implementing quality alerts (including changes to manufacturing process instructions, changes to test process etc.) from Oracle. This includes training operators on the new process and maintaining records of the training in the on-line system in Item 1 on Page 85.

Minimal Acceptable Practice:

The same as Best Practice except:

1. One or more of the items in Item 1 of Best Practice on Page 85 are not necessarily automated and may rely on a manual system.

2. Item 3 of Best Practice on Page 86 is a not necessarily an automated system. The site can demonstrate that the manual system is effective in preventing an operator with expired training from performing the task without qualified supervision.

3. Each employee's badge does not necessarily include a record of their current certification and training. However, the site maintains records that show the employee's training and certification are current.

4. There is a base set of training that is required for all employees who enter the production floor.

5. The site has an effective process for receiving and implementing quality alerts (including changes to manufacturing process instructions, changes to test

process, etc.) from Oracle. This includes training operators on the new process and maintaining records of the training.

Unacceptable Practice:

1. One or more of the items in item 1 of Best Practice on Page 85 are not implemented either online or manually.
2. One or more of items 2 through 5 of Minimal Acceptable Practice above are not implemented.

10 Sub-tier Supplier Management

10.1. Supplier Sub-tier Supplier Management

Goal:

Ensure the processes are in place to prevent quality issues and out-of-spec parts from escaping the supply chain and entering the factory.

Definitions:

Part – A component or assembly which includes FABs, packaging, power supplies, sub-assemblies, chassis, boards, ICs, resistors, capacitors, etc.

New part – A new or changed part for an Oracle product coming from any source. An unchanged part for an Oracle product coming from a new facility or a new supplier

New process – The same process at a new facility or a significant process change (e.g., new SMT machine, solder profile change, test process change) at the same facility

Best Practice:

1. There is a quality contract in place with all sub-tier suppliers that includes: adherence to ISO 9001 standards, inspection processes to ensure quality, Root Cause Corrective Action (RCCA), engineering support and response time to quality issues, and safety standards to ensure continuity of supply.
2. A FAI (First Article Inspection) process is in place for all new and all modified parts and for parts from new suppliers. The FAI verifies product specifications and all critical to function dimensions.
3. Specifications and drawings on all incoming parts are electronically available at Incoming Quality Control. Calibrated equipment (templates, measuring devices,

etc.) is available in incoming Quality Control to check the conformance to specification and critical to function dimensions of incoming critical parts (e.g., PCB's, packaging, chassis). SPC control charts, with lot rejection criteria, are available and used for all critical electronic and mechanical parts. Incoming sample inspection to a 0.65% AQL level shall be performed. Parts are placed on "Dock-to-Stock" status after successful sampling to 0.65% AQL is achieved.

4. The supplier maintains a global electronic repository for FAIs. All FAIs are stored in this repository. This global repository is available to and is used by all supplier locations that produce Oracle products.

5. There is a documented inspection process to track specifically identified/agreed critical parts and critical to function dimensions. The inspection results are stored in an electronic record with a 10 year availability.

6. Section 9.1, *ESD Controls,* Best Practices on Page 80 are followed by the Sub-tier Supplier when handling all ESD sensitive electronic components.

7. There is minimal or no history of non-conforming material from Sub-tier Suppliers disrupting production.

8. "Dock-to-Stock" status expires after six months and sample inspection to a 0.65% AQL level shall be performed, and if results are favorable, part shall go back onto Dock to Stock. Repeat every six months.

9. The supplier has a Sub-tier Supplier Score Card Process. Each Sub-tier supplier is audited at least once per year. If the audit results are at an acceptable level according to the supplier's Sub-tier Supplier Score Card Process, the supplier will continue to be audited once per year. If the audit results are below an acceptable level according to the supplier's Score Card Process, the sub-tier supplier is audited more frequently. Sub-tier Supplier audit results, including audit findings and corrective actions, of previous audits are available online via a global repository. The sub-tier audit should include processes that are used to manufacture all components qualified on Oracle products (even if they are currently not being purchased by Oracle or our EMs).

10. Evidence exists to confirm that the Sub-tier Supplier has an effective RCCA process for internal and external quality issues.

11. The supplier conducts regular quality reviews with all Sub-tier Suppliers. Results of the reviews are available.

12. The supplier has a documented process for qualifying and disqualifying Sub-tier Suppliers.

13. The supplier has a “Black List Process” for parts that should never be used on any Oracle product. The supplier's Black List Process incorporates Oracle's Black List. The supplier has a global process for communicating and updating its sub-tier suppliers with the Blacklist.

Minimal Acceptable Practice:

1. Quality contracts are not yet in place with all Sub-tier Suppliers. However, the site has an active program with a timeline to implement quality contracts with most Sub-tier Suppliers. Quality contracts include: adherence to ISO 9001 standards, inspection processes to ensure quality, Root Cause Corrective Action (RCCA), engineering support and response time to quality issues.

2. A FAI (First Article Inspection) process is in place for most new and all modified parts and for parts from new suppliers. The FAI verifies product specifications and all critical to function dimensions.

3. Specifications and drawings on all incoming parts are available in supplier's Incoming Quality Control (IQC). Calibrated equipment (templates, measuring devices etc.) is available in IQC to check the conformance to specification and critical to function dimensions of incoming critical parts (e.g., PCBs, packaging, chassis). Doc to Stock status remains in place until a problem occurs or there is a change to form, fit or function. Incoming sample inspection to a 0.65% AQL level shall be performed. Parts/vendors are placed on “Dock-to-Stock” status after successful sampling to 0.65% AQL is achieved.

4. The supplier maintains a local repository for FAIs. All FAIs are stored in this repository. Information on FAIs is made available to other supplier locations upon request.

5. There is a documented inspection process to track specifically identified/agreed critical parts and critical to function dimensions. The inspection results are stored in an electronic record with a 10 year availability.

6. Section 9.1, *ESD Controls*, Minimal Acceptable Practice on Page 81 are followed by the Sub-tier Supplier when handling all ESD sensitive electronic components.

7. There is minimal or no history of non conforming material from Sub-tier Suppliers disrupting production.

8. “Dock to Stock” status remains in place until a problem occurs or there is a change to form, fit, or function.

9. Evidence exists to confirm that the Sub-tier Supplier has an effective RCCA process for internal and external quality issues.

10. Each Sub-tier Supplier is audited at least once per year to the supplier's quality standard. If the audit score is above supplier's expectation, the Sub-tier Supplier will continue to be audited once per year. If the audit results are not acceptable, the Sub-tier Supplier will be audited twice per year until acceptable audit results have been achieved. Results of previous audits are available including audit findings and corrective actions to be taken. The sub-tier audit should include processes that are used to manufacture all components qualified on Oracle products (even if they are currently not being purchased by Oracle or our EMs).

11. The supplier conducts quality reviews with all Sub-tier Suppliers. However, they are not conducted to a regular schedule. Results of the reviews are available.

12. The supplier has a process for qualifying and disqualifying Sub-tier Suppliers.

13. The supplier has a "Black List Process" for parts that should never be used on any Oracle product. The supplier's Black List Process incorporates Oracle's Black List.

Unacceptable Practice:

One or more of items 1 through 13 of Minimal Acceptable Practice on Page 89 are not followed.

References:

914-1756-xx; *WWOPS Quality: IQC/DTS Minimum Expected Specification*

Mil Standard 105E, *Sampling Procedures and Tables for Inspection by Attributes* or ANSI/ASQC Z1.4-1993

ISO 9001:2000, *Quality Management Systems – Requirements*

11 Export Practices

11.1 Export Compliance

Export Laws

Products, services, technology, materials, tools, and technical data delivered by or to Oracle may be subject to US export controls or the trade laws of other countries.

Company/supplier and Oracle agree to comply with all export control regulations and acknowledge that they have the responsibility to obtain such licenses to export, reexport, or import as required. Company/supplier and Oracle agree not to export or re-export to entities on the most current US export exclusion lists or to any country subject to US embargo or terrorist controls as specified in the US export laws. Company/supplier and Oracle do not use or provide products, services, technology, materials, tools, and technical data for nuclear, missile, chemical, or biological weaponry end uses.

Best Practice:

1. Processes exist to address US export control laws.
2. US Export Control laws are strictly observed and followed.
3. There is documented evidence to support items 1-2 above.

Minimal Acceptable Practice:

Same as Best Practice above.

Unacceptable Practice:

One or more of Best Practice above are not followed.

12 Acronyms

AMD	Advance Micro Devices
ANSI	American National Standards Institute
AOI	Automated Optical Inspection
AQL	Acceptable Quality Level
AQP	Advanced Quality Planning
ASIC	Application Specific Integrated Circuit
ASQ	American Society for Quality Formerly known as American Society for Quality Control (ASQC).
AVL	Approved Vendor List
BFT	Board Functional Test
BGA	Ball Grid Array
BOM	Bill of Material
CM	Contract Manufacture
CPAS	Corrective and Preventative Action System
CPLD	Custom Programmable Logic Device
CPU	Central Processing Unit
CRU	Customer Replaceable Unit
DIMM	Dual Inline Memory Module
DTS	Dock to Stock
EAN-UCC	European Article Numbering-Uniform Code Council
ECO	Engineering Change Order
EDX	Energy Dispersive X-Ray
EIA	Electronic Industries Association

EM	External Manufacturer
ESD	Electro Static Discharge
FA	Failure Analysis
FAB	Bare printed circuit board (not a board assembly)
FAI	First Article Inspection
FIFO	First In First Out
FRU	Field Replaceable Unit
FRUID	Field Replaceable Unit Identification
GPI	General Purpose Interface
ICT	In circuit test
IC	Integrated Circuit
IEC	International Electrotechnical Commission
IPC	IPC Association connecting electronic industries (global specifications and standards supplier)
IQC	Incoming Quality Control
ISO	International Organization for Standardization
IST	Initial System Test
IT	Information Technology
JEDEC	Joint Electron Device Engineering Council
LED	Light Emitting Diode
LGA	Land Grid Array
MAL	Minimum Acceptable Dash Level
MICTOR	Matched Impedance Connector
MRB	Material Review Board
MSDS	Material Safety Data Sheet

ODW	Operational Data Warehouse
OEM	Original Equipment Manufacturer
OS	Operating System
ORT	On-going Reliability Testing
PA	Process Alert
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
PE/SE	Product engineer/supplier engineer
PGA	Pin Grid Array
PM	Preventative Maintenance
PMC	Preventative Maintenance Coordinator
POH	Power On Hours
POST	Power On Self Test
PPA	Post Pack Audit
PTH DCDC	Pin-through-hole DC-to-DC converter or power supply printed circuit board
RA	Replaceable Assembly
RAL	Repair Acceptable Dash Level
RCCA	Root Cause and Corrective Action
RQT	Reliability Qualification Testing
R&R	Repeatability and Reproducibility
RSL	Remote Stocking Location
RV	Repair Vendor
SEM	Scanning Electron Microscope
SFT	System Functional Test

SLA	Service Level Agreement
SMT	Surface Mount Technology
SOW	Statement of work
SPC	Statistical Process Control
SPARC	Scalable Processor Architecture
SSG	Scalable Systems Group
SWDL	Software Download
SWIE	Software Infrastructure Engineering
TDMS	Test Data Management System
TTF	Time to failure
VHDM	Very High Density Metric
WIP	Work in process
WWN	World Wide Number
WWOPs	World Wide Operations
ZIF	Zero Insertion Force

Reference Information

Reference Documents and Records

Document Title [1]	*Number*	*ESO Controlled*		*Quality Record*	
		Yes	*No*	*Yes*	*No*
WWOPS Process Technology: Printed Circuit Board Assembly Workmanship Standards	910-1021-xx	X			X
Corporate FRU ID: Glossary	913-3217-xx	X			X
WWOPS Product Lifecycle and Technology: Manufacturing/Operations Requirements Advanced Quality Planning (AQP) Matrix	913-3592-xx	X			X
WWOPS Supply Management: Standard for CPU and ASIC Marking	914-1730-xx	X			X
WWOPS Systems: Ongoing Reliability Testing (ORT) Policy	914-1736-xx	X			X
WWOPS Sparc Volume Operations: Strain Gage Test Procedure	914-1739-xx	X			X
WWOPS Quality: IQC/DTS Minimum Expected Specification	914-1756-xx	X			X
WWOPS SPARC: SPARC Processors Cleaning Procedure at Disassembly	914-1760-xx	X			X
WWOPS Quality: Specification of Bar-coded Identification Labels for Packaged Raw and Semi-Finished Materials	917-1335-xx	X			X
Corporate FRU ID: Getting Started for FRU Vendors	917-1914-xx	X			X
Corporate FRU ID: Process Tasks for FRU Vendors	917-1915-xx	X			X
Corporate FRU ID: Utilities for FRU Vendors	917-1916-xx	X			X
Corporate FRU ID: FRUUpload Administration Guide for External Manufacturers	917-1917-xx	X			X
WWOPS Manufacturing: Global Cosmetic Quality and Workmanship Standards	923-2001-xx	X			X
WWOPS Technology: Creating Universal Product Codes (UPC)	923-3308-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.

WWOPS Supplier Management: Embedded Logic in Serial Numbers, Lot Codes, and Assembly Identifications (IDs)	923-3383-xx	X			X
WWOPS Process and Quality: Supplier Traceability Requirements	923-3406-xx	X			X
WWOPS Process and Quality: Supplier Traceability Technical Specifications for Supplier Data Feed (XML Format)	923-3407-xx	X			X
WWOPS Process and Quality: Supplier Traceability Technical Specifications for Supplier Data Feed (Flat File Format)	923-3409-xx	X			X
WWOPS Technology: Host ID Acquisition and Derivation	923-3521-xx	X			X
WWOPS Technology: Unique Identification of Product in Accordance with U.S. Department of Defense Standards	923-3550-xx	X			X
WWOPS Engineering: Product and Test Data Requirements	923-3559-xx	X			X
WWOPS Supplier Engineering: Quick Start Guide for New FTP Account for Field Replaceable Unit Identification (FRUID) Data Collection	923-3592-xx	X			X
WWOPS Technology: Post Pack Audit (PPA) Master Requirements Specification, Server Products	923-3663-xx				
Corp: Part Number, Revision, and Interchangeability Conventions for Orderable and Manufacturing Items	990-1241-xx	X			X
Oracle Specifications					
Rejectable New Packaging Materials	425-1016-xx		X		X
Specifications and Used Packaging Material	425-1017-xx		X		X
Rejectable Packaging Graphics	425-1018-xx		X		X
Pallet Requirements for Shipping Inbound and Outbound	425-1019-xx		X		X
Procedure for Packaging First Article	425-1128-xx		X		X
Operations Incoming Packaging Requirements	425-1138-xx		X		X
Plastic Packaging Labeling	425-1165-xx		X		X
Packaging Specification: OEM Development Criteria	425-1184-xx		X		X
Fabrication Specification Printed Wiring Boards	950-1009-xx		X		X
Bar Code Marking Standard for Suppliers	950-1037-xx		X		X
Specification of Identification Labels for Packaged Finished Goods	950-1419-xx		X		X
Customer Information Sheet (CIS) Specification	950-1647-xx		X		X
Specification for Materials used to Close, Seal, and Secure Containers	950-1685-xx		X		X
Bar Code Label Requirements for Modules, Memory Cards, and	950-2252-xx		X		X

SIMMs					
Corporate FRUID: SEEPROM Programming Overview and Procedures for FRU Vendors	950-3757-xx		x		x
Identification, Labeling, and Bar Coding standards for Assemblies	950-4477-xx		x		x
Industry Standards					
100015-1, Basic Specification: Protection of Electrostatic Devices - Part 1 General Requirements					
ANSI 10.8.1, Linear Bar Code and Two-Dimensional Symbols used in Shipping, Receiving, and Transport Applications					
ANSI/ESD S20.20-1999, For the Development of an Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)					
*EIA-476-B, Date Code Marking- partial revision of EIA 476-*A					
EIA-556, Outer Shipping Container Label Standards					
ESD TR53 - ESD Technical Report53					
IEC 61340-5-1, Protection of Electronic Devices from Electrostatic Phenomena – General Requirements					
IPC-7711 Rework of Electronic Assemblies					
IPC-7721 Repair and Modification of Printed Circuit Boards and Electronic Assemblies					
IPC-A-600, Acceptability of Printed Boards					
IPC-A-610, Acceptability of Electronic Assemblies					
IPC-CM-770, Component Mounting Guidelines for Printed Boards					
IPC/JEDEC-9704, Printed Wiring Board Strain Gage Test Guideline					
IPC-SM-840, Qualification and Performance of Permanent Solder Mask					
IPC-TM-650, Test Methods Manual - Bow & Twist					
ISO 9001:2000, Quality management systems – Requirements					
ISO 14644 Clean room standards					
JEDEC JESD97, Marking and Symbols and Labels for Identification of Lead Free Assemblies, Components and Devices					
J-STD-001, Requirements for Soldered Electrical and Electronic Assemblies					
J-STD-033, *Standard for Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices*					
Mil Standard 105E, and Mil 1019 Sampling Procedures and Tables for Inspection by Attributes or ANSI/ASQC Z1.4-1993					
PCWA Workmanship Standard					
Printed Wiring Board Strain Gage Test Guideline, IPC/JEDEC-9704					

Document History and Approvals

Dash	*Rev*	*Date*	*Description of Change*	*Originator*
01	A	24 Oct 2008	Initial release.	N/A
			Agile History	
Rev		***Date***	***Description of Change***	***Originator***
02		23 Oct 2013	Change from Sun to Oracle format, remove Sun throughout, remove Sun links and delete obsolete or inactive documents 923-3582, 923-3583, 923-3685, 923-3408, and 923-3667.	N/A
03		12 Aug 2016	**Added** 9.1 ESD Controls, Best Practice: 4. The site has a designated ESD manager for each functional area. **Updated:** From IPC-A-610D to IPC-A-610 **Removed** 9.1 ESD Controls, Industry Standards: IEC_QC_080000, Electrical & Electronic Components and Products Hazardous Substance Free Standard and Requirements Reference Documents and Standards: IEC_QC_080000, Electrical & Electronic Components and Products Hazardous Substance Free Standard and Requirements	N/A
04		15 May 2017	Added statement - "The sub-tier audit should include processes that are used to manufacture all components qualified on Oracle products (even if they are currently not being purchased by Oracle or our EMs)" to Section 10.1 subsection Best Practice (clause 9) and subsection Acceptable Practice (clause 10). Removed reference to obsolete document 923-3578.	N/A