



Administrative Quality Best Practices

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Abstract: This document identifies nine administrative quality defect categories: Damage, Labeling, Non-Receipt (carrier related), Packing, Paperwork, Wrong Product, Wrong Quantity, Datecode, and Orientation. Each category is defined, illustrated with examples, and followed by best practices recommended and supported by SEMATECH. Its purpose is to help member companies improve processes that cause administrative quality defects. This revision deletes a previous category, Device Marking, while adding Datecode and Orientation. A few other minor corrections have been made to the text.

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Authors: Andy Lesko (IBM)

Approvals: Noel Durrant, Project Manager
Alex Oscilowski, Director
Laurie Modrey, Technical Information Transfer Team Leader

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1 EXECUTIVE SUMMARY

This document is the result of a survey undertaken by SEMATECH's Quality Council that identified administrative quality as a leading cause of customer dissatisfaction. The purpose of the document is to help member companies improve the processes that cause administrative defects. The document identifies nine categories of administrative quality defect: Damage, Labeling, Non-Receipt (carrier related), Packing, Paperwork, Wrong Product, Wrong Quantity, Datecode, and Orientation. Each category is defined, illustrated with examples, and followed by best practices recommended and supported by SEMATECH.

2 BACKGROUND

2.1 HISTORY

In late 1996, SEMATECH's Quality Council completed a customer survey with semiconductor customers of SEMATECH's members. The survey indicated that one of the top customer satisfaction measures causing dissatisfaction was administrative quality. The dissatisfaction was serious enough that the Council decided a special effort should be devoted to understanding the causes of dissatisfaction and to correcting them with some "best practices" that can be used by member companies. Therefore, a working group now known as the Administrative Quality Forum was formed with representatives of nine member companies. The directive given to this team was to determine how best to solve the administrative quality defects among the member companies.

2.2 DEFINITION

An administrative quality issue is one that results in an interruption to the customer's normal processing flow and is not related to product functionality/visual mechanical or on-time delivery.

2.3 SCOPE

The scope of this white paper includes the processes, programs, and systems that impact Administrative Quality issues in semiconductor finished goods.

2.4 MISSION

Define a list of best practices and strategies to improve administrative quality.

2.5 OBJECTIVE

To deliver a list of strategies and best practices by a prescribed date to the SEMATECH Quality Council for use by members to improve processes that cause administrative quality defects.

2.6 ACRONYMS/TERMS

The following acronyms are used throughout this white paper:

2D = two dimensional symbology bar-coding

AMD = Advanced Micro Devices

AQ = Administrative Quality

ASAP = As Soon As Possible

ASTM = American Society of Testing Methods
C/A = Corrective Action
Cell/Brick concept = 1 lot on 1 bench at a time
chip-set = a matched number of semiconductors
CSR = Customer Support Rep
DEC = Digital Equipment Corporation
e.g. = example given
EIA = Electronics Industry Association
etc. = et cetera
FIFO = First In First Out
H-P = Hewlett-Packard Company
HIC = Humidity Indicator Card
IBM = International Business Machines
intermediate/sub-pack = sealed bag, box
IOPP = Institute of Packaging Professionals
IATA = International Air Transport Association
JEDEC = Joint Electron Device Engineering Council
NEDA = National Electronic Distributor Association
Lot = Lot traveler, work order, process order, etc.
PCN = Process Change Notification
ROM = Read Only Memory
ship pack = box, pallet, container, crate
SLF = Semiconductor Logistics Forum
TAT = TurnAround Time
TI = Texas Instruments, Inc.
unit pack = tube, reel, sealed bag, trays

3 GENERAL GUIDELINES

The following section provides guidelines for achieving high administrative quality (AQ). Recommendations and best practices are proposed to improve AQ in the following nine AQ defect categories:

- Damage
- Labeling Error
- Shipping Error
- Datecode
- Orientation
- Packing Error
- Paperwork Error
- Wrong Product
- Wrong Quantity

For each of these defect categories, the member companies have proposed several specific best practices. Before working to implement the specific recommendations in these nine categories, it is equally important to adopt an overall AQ strategy. A successful strategy for achieving high AQ should include the following elements:

Automation. Increasing automation of manufacturing and test operations has clearly had a positive impact on defect reduction. Similarly, automation of inventory, inspection, and order fulfillment operations will lead to significant reduction in AQ related defects. Improvements in both cases are based on the same premise: that less manual intervention leads to fewer defects.

Training. The semiconductor industry has traditionally emphasized training manufacturing and test personnel. A similar emphasis is required on the training of personnel performing downstream operations, to include formal job qualification and cross-training. Diligence observed in manufacturing a quality product is for naught if the product is not handled, packed and, shipped by trained and qualified personnel.

Equipment Maintenance. Inspection, marking, labeling, and packing equipment requires the same high levels of attention and preventive maintenance as required for manufacturing and test. Poor maintenance of equipment (e.g., bag sealers, label printers, etc.) can easily lead to customer returns of thousands of devices.

Documented Procedures. Adequate documentation of the processes affecting AQ is often overlooked. Inspection, handling, packing and shipping processes need to be thoroughly documented in order to provide the guidance needed to consistently and accurately perform these operations. Proper documentation is critical because of a lack of a stable and therefore, knowledgeable workforce, which would make it easier to follow procedures.

AQ Management System. Effective management of AQ information and required actions is critical to continuously improving AQ. An effective AQ management system will at a minimum

Identify and track both, internal and customer identified issues affecting administrative quality

- segregate parts that have been tested or reworked. Assure all personnel are trained in the relevant procedures, which provide for parts to be positively identified before being packaged.

Quickly contain AQ issues

- when purging inventory (by lot trace code and quantity) for containment, a physical count of all inventory is validated against the inventory data base.

Ensure root cause analysis and corrective action

Ensure a closed-loop customer communication (internal and external customers)

Use best practices identified

Identify/define new best practices

An effective AQ program should carefully consider these elements when developing plans to improve AQ. A program using the concept of facilitator/mentor available for individuals is desirable. Also, recognition of individuals and teams is an important part of any quality program. The lessons learned in processing customer issues and corrective actions should be shared with SEMATECH for further worldwide best practice implementation for all semiconductor

companies. Representatives from the member companies have also identified the following *specific* best practices to eliminate defects in each of the nine AQ defect categories.

4 ADMINISTRATIVE QUALITY DEFECTS LISTING WITH BEST PRACTICES

Administrative Quality defect categories have been established by the AQ Forum members. The categories include Damage, Labeling, Device Marking, Non-Receipt (carrier related), Packing, Paperwork, Wrong Product, and Wrong Quantity. Each category has a definition and a breakdown with examples as appropriate. Following these are best practices recommended and supported by SEMATECH.

Problem: Category	Breakdown	Definition	Examples
Damage		Defects caused after the product was packaged for shipment. The shipment was received with punctured, crushed, broken product, tubes, trays, reels, and/or boxes.	
	Packing	Refers to materials used to pack finished product. Tubes, reels, bags, boxes are broken, punctured, crushed, etc.	Cracked tube/tray, crushed reel, torn bag, crushed shipping container.
	Product	Units (individual, sets, box, box) are broken, crushed, chipped.	Bent leads, broken/chipped/scratched part, etc.
Best Practices			
– Ensure packing complies with industry standard			

Problem: Category	Breakdown	Definition	Examples
		<ul style="list-style-type: none"> – ASTM, IATA, EIA, etc. – perform drop and vibration test at the box level – Understand damage defects and work with carriers to ensure prevention <ul style="list-style-type: none"> – storage and shipment defects – Use data from IOPP (Institute of Packaging Professionals) – Follow NEDA and JEDEC standard packing – Follow SEMATECH SLF (Semiconductor Logistics Forum) <ul style="list-style-type: none"> – Recyclable/Reusable – Product protection – Standard sizes 	
Labeling Error		Labels on unit pack (tube, reel, bag), intermediate/sub-pack (bag/box) or ship pack (box, pallet, container, crate) are missing, contain incorrect or missing data, placed in the wrong location or does not match the documentation and product.	
	Improper Placement	Labels are incorrectly placed on unit pack, intermediate/sub-pack or ship pack per the standard/customer specifications.	Upside down, wrong side, inside placement vs. outside of bag, etc.
	Incorrect Data	Labels contain inaccurate information.	Wrong part number, quantity, lot number, bar-code, space/layout specifications, customer information.
	Incorrect Label	Labels on unit pack, intermediate/sub-pack (bag/box) or ship pack (box, pallet, container, crate) are not per the standard/customer specification.	Missing or wrong customer label.
	Missing Data	Required information is missing from labels	Missing data identifier; spaces as required, complete part number, lot numbers, etc.
	Missing Label	Labels are not on unit pack intermediate/sub-pack (bag/box) or ship pack (box, pallet, container, crate) as required.	Fell off, never placed or covered.
	Other	labeling issues not including the above problems	Readability issues, quality of printing/label, bar-code symbology, damaged.
Best Practices			
		<ul style="list-style-type: none"> – Company wide standardized labeling software – Standard quantities per NEDA – Label design per EIA standards – Validation process at every pack level to ensure physical contents match labeling contents. – Visual aids for key process steps (e.g.: label placement, content, etc.) 	

Problem: Category	Breakdown	Definition	Examples
		<ul style="list-style-type: none"> – Labels are completed prior to shift changes or breaks – Mistake proof workstation layout (e.g.: self-contain, with printer) – Automation of labeling processes/data downloading to avoid human errors – No more than one lot processed per workstation to prevent mixing product/labels – Avoid multiple lot batch printing to prevent cross-labeling – Maximize the use of standard labels, where possible – Where customer specific requirements apply, print them at the lowest level possible – Print and apply label where packing is performed <ul style="list-style-type: none"> – Do not store multiple labels at the labeling area – Discard unused labels after each lot is packed and labeled – Last person to positively identify the part is the same person who applies the barcode or part number label. – Company wide bar-code readability, verification and process control – Old or damaged labels are removed or overlaid with a new label immediately when discovered and positively identified. 	
Shipping Error (carrier related)		Customer claims shipment was not received, or a portion of shipment was missing. Non-receipt does not include short shipments or incomplete systems, kits, or chip-sets.	
	Missing Full Shipment	The entire shipment was reported as not delivered.	
	Partial Shipment	A portion of the shipment was not delivered	(i.e.; box 2 of 5 was not delivered)
	Late Delivery	Shipment was shipped on time and delayed in arrival.	Carrier did not meet turnaround time.
	Incorrect Routing	The shipment was routed another method/carrier without customer approval	Shipped carrier A vs. carrier B
	Wrong Delivery	Carrier delivered full or partial container(s) to wrong customer/destination.	
Best Practices			
		<ul style="list-style-type: none"> – Establish long term relationships with Carriers for best service <ul style="list-style-type: none"> – Minimize the number of carriers – Periodic feedback to Carrier <ul style="list-style-type: none"> – Measure and feedback their performance – Supplier defines Carrier <ul style="list-style-type: none"> – Identify advantages of using supplier's carrier to customer – Set Goals for Carriers <ul style="list-style-type: none"> – Tie compensation to Goals – Use tracer for high value shipment 	

Problem: Category	Breakdown	Definition	Examples
Datacode		Assembly and bagseal datecode does not meet internal/customer specification.	
	Aged/Outdated	Exceeded internal/customer datecode required	Product shipped beyond one year spec required. Bagseal datecode expired.
	Mixed	Product shipped exceeds the number of datecodes per specifications in a box or shipment	
Best Practices			
		<ul style="list-style-type: none"> – Provide automatic inventory flag to identify product for needed action (age, change) – Assure isolation of aged product not shippable – Provide repack instructions for distributors – Use FIFO 	
Orientation		Parts/unit pack are not oriented per specification	
	Misoriented	parts are not oriented per specifications	parts turned 90 or 180 degrees
Best Practices			
		<ul style="list-style-type: none"> – Tray design – eliminate possibility for orientation errors – Use bakeable tape & reel/tray assemblies to reduce handling for rebake – Provide repack instructions for distributors 	
Packing Error		Unit pack (tube, Reel, tray, sealed bag), intermediate/sub-pack (bag/box) or ship pack (box, pallet, container, crate) are not packed per standards or customer specifications.	
	Aged Product	Product shipped is not within company/customer aged product specifications or does not meet customer specifications.	Bagseal datecode expired, not FIFO product, Product datecode is beyond the maximum time allowed to use without a reprocessing check.
	Incorrect Packing	Packing of units within carriers, intermediate boxes or shipment containers is not adequate or correct per specifications.	Items such as missing tube end stoppers (caps), missing box end pads, insufficient bubble wrap, improper pallet stacks or pack, excess weight allotted per specifications.
	Misoriented Standard	Parts not oriented per specifications Product not packed per standard increment specifications of supplier or customer.	Parts turned 90 or 180 degrees Includes full tubes, trays reels or boxes.
Best Practices			
		<ul style="list-style-type: none"> – Order/Ship Full Box – Use tray from single supplier or assure compatibility – Use uniform temperature rated trays – Use bakeable tape and reel assemblies to reduce handling for rebake 	

Problem: Category	Breakdown	Definition	Examples
			<ul style="list-style-type: none"> – Packing instructions automatically downloaded from database for packing integrity – Provide repack instructions for distributors – Understand packing design and accommodate the environment that the product will be exposed to in shipment
Paperwork Error		Packing lists, shipment documentation, Certificate of Compliance or customer specific documentation is illegible, incorrect or missing from the shipment.	
	Illegible	The data on paperwork is not readable.	Smears, damaged, handwriting.
	Incorrect	The paperwork or data on paperwork is incorrect and does not meet requirements of specifications or regulations.	Wrong part numbers, quantity, address, carrier, or method of shipment.
	Missing	The required paperwork was not included with the shipment.	Test data, bill of lading, etc.
Best Practices			
		<ul style="list-style-type: none"> – Automation <ul style="list-style-type: none"> – No handwriting allowed – Readable font size where allowable – When not automated, verify printed material – Keep current on import/export requirements 	
Wrong Product		The product received was different from what the customer ordered or expected.	
	Mixed Product	Shipment contains more than one type of unit in tubes, trays, reels, or boxes	More than one part number, binning speed, revision, etc.
	Incorrect Product	Shipment contains incorrect product.	Part no., chip-set, product, non-qualified product, non-conforming product, changed product (no PCN), revision level.
Best Practices			
		<ul style="list-style-type: none"> – Cell/Brick Concept – 1 lot on 1 bench at a time – Physical and systemic segregation of non-conforming product – Paperwork never leaves product – Validate final product to paperwork, and labels to database – Automation is key – eliminate human intervention <ul style="list-style-type: none"> – eliminate overrides – eliminate pulling parts for inspection, if needed, use cell/brick concept – auto part number verification – use bar-code or license plate <p>Follow JEDEC PCN requirement</p>	

Problem: Category	Breakdown	Definition	Examples
– Provide automatic inventory flag to identify changed product (PCN)			
Wrong Quantity		The quantity of units, boxes or products received was over or short of the quantity the customer expected.	
	Overage	The quantity received was more than the customer expected.	A quantity greater than the ordered and expected quantity was shipped. A double order was shipped.
	Shortage	The quantity received was less than the customer expected.	A mixed product and/or wrong product caused the quantity to be short of the expected product quantity. A wrong product was shipped causing a shortage of the expected product.

Best Practices

- Use of full boxes (minimum order quantity, standard pack quantity)
- Partial boxes get top priority for inspection of wrong quantity, mixed and misoriented parts.

Process Automation

- Auto Error Checking
- Equipment design fool proofing
- Bar-coding use
- License plates
- If it must be a manual system:
 - Use Cell/Brick concept: 1 lot/part # on 1 bench @ a time
 - Verification (see para. 1.7)
 - Weigh boxes for count verification
 - Training required continuously
 - Data Entry / Certified Operators by operation / Cross Job Training
 - Physical & systemic segregation of non-conforming material
 - Paperwork should never leave the lots during process

5 AQ VERIFICATION

AQ Verification

The following list is a guide/checklist for AQ verification.

Check

- Part to labels to paperwork
 - Incorporate finished goods to end item users cross-reference system to prevent the possibility of parts being shipped to the wrong plant.
 - Count, if sealed bag by label
 - Date code requirements met
 - Bag seal date is not expired
 - Orientation of parts
 - Label to customer requirements are correct
 - Package integrity
 - Validate and verify changes to packing labels for proper quantity and end item part number when new product designs or revisions are implemented into the production process.
 - For obvious visual/mechanical defects
 - Torn or open bag seals
 - Humidity indicator card (HIC), if visible
-

6 ADMINISTRATIVE QUALITY REPORTING SYSTEM

The following information is recommended as a minimum in issue reporting. It is useful to have it in a standard format; for consistency and evaluation measures and improvement opportunity reviews. However, most important is the information received so appropriate action can be taken.

In addition to the minimum information required, it was recommended that each plant site appoint a coordinator for all customer issues to facilitate and direct the issue to the proper owner for resolution and corrective action.

FLOW (input to final closure)	Best Practice Characteristics (provide minimum dataset input)
Customer Input	<ul style="list-style-type: none"> – Reported by: – Date Identified: – Owner – Customer Contact: – Customer Contact Phone #: – Customer Impact: – Customer Identification: – Quantity or Parts (order/received): – Product: – Part Numbers: – Lot Numbers: – Order Number: – Problem Type: – Problem Category – Description of Problem: – Tracking Number: – Customer Requested Date for Response

FLOW (input to final closure)	Best Practice Characteristics (provide minimum dataset input) (continued)
Customer Support Rep (CSR)	<ul style="list-style-type: none"> – Serves as the central customer knowledge base/relationship filter – Identifies owner – Initiate containment action & resolve customer impact – Inputs into database
Central Coordinator	<ul style="list-style-type: none"> – Acknowledge problem to customer – Provide tracking reporting <ul style="list-style-type: none"> – Who – Metrics with management review – Actions – Decide need and form team when required – Escalate when required – Very quality of Corrective Action – Assure Corrective Action timeliness
Owner	<ul style="list-style-type: none"> – Recognize and accept ownership – Verify the problem – Identify Scope of problem – Identify root cause – Identify interim and long term Corrective Action – Implement interim and long term Corrective Action – Provide ongoing status reporting – Validate Corrective Action
Central Coordinator or Customer Support Rep	<ul style="list-style-type: none"> Express regrets to customer Provide customer with Corrective Action report Obtain customer agreement to Corrective Action (closed loop) Communicate proof of Corrective Action effectiveness Obtain customer satisfaction feedback

7 AQ REPORTING SYSTEM METRIC FOR CONTINUOUS IMPROVEMENT

A reporting system should provide feedback with the following elements:

-
- Tracking dates for turn-around-time (TAT)
 - Customer input date
 - Coordinator received date
 - Containment date
 - Interim Corrective Action date (implemented)
 - Final Corrective Action date (implemented)
 - Closure date to customer
 - Goals for turn-Around-Time (TAT)
 - Management Review
 - Identify Repeats
 - PPM use
 - Paretos for Continuous Improvement
 - root cause
 - problem categories
 - repeats
 - occurrences based upon manufacturing date
-

8 TURN-AROUND-TIMES BEST PRACTICE

	Cumulative days	
	standard	urgent
– Standard reporting inputs by customer	ASAP	ASAP
– Acknowledge problem, verification & containment	2	1
– Problem analysis and corrective action identified with implementation schedule communicated to the customer.	23	9
– Long term actions	Ongoing	Ongoing

APPENDIX A

List of representatives to the Administrative Quality Forum

The nine member companies participating are Texas Instruments, IBM, Lucent Technologies, AMD, Intel, Rockwell Semiconductor Systems, Digital Semiconductors, National Semiconductor and Hewlett-Packard. The representative(s) of each company are as follows:

Name	Company	
Murray Seaman	IBM, Burlington, VT. Chairperson	mseaman@vnet.ibm.com
Andy Lesko	IBM, Burlington, VT. Leadperson	alesko@us.ibm.com
Larry Miles	IBM, Burlington, VT.	Lmiles@us.ibm.com
Lynn Rickel	Rockwell Semiconductor Systems, Newport Beach, CA.	Lynn.Rickel@npbsmtpl.nb.rockwell.com
Lynn Alcala	Rockwell Semiconductor Systems, Newport Beach, CA	Lynn.Alcala@npbsmtpl.nb.rockwell.com
Debbie Parrish	Rockwell Semiconductor Systems, Newport Beach, CA	Debbie.Parrish@npbsmtpl.nb.rockwell.com
David Lehtonen	AMD, Austin, TX.	David.lehtonen@amd.com
Jim Slevin	AMD, Sunnyvale, CA.	Jim.Slevin@amd.com
Sean McDonough	Digital Semiconductor, Hudson, MA	Mcdonough@digital.com
Phil Bedard	Digital Semiconductor, Hudson, MA	Pbedard@digital.com
Stanley Drennon	Intel, Chandler, AZ.	Stanley_Drennon@ccm.ch.intel.com
Walt Turansky	Intel, Chandler, AZ.	Walt_turansky@ccm.ch.intel.com
Charla R. Frain	Intel, Chandler, AZ	Charla_R_Frain@ccm.ch.intel.com
Robert Alexander	Intel, Chandler, AZ.	Robert_M_Alexander@ccm.ch.intel.com
Sally Wong	Intel, Chandler, AZ.	Sally_Wong@ccm.ch.intel.com
Betsy Lorenzen	Intel, Chandler, AZ.	betsy_a_lorenzen@ccm.ch.intel.com
Denise Lawrence	Lucent Technologies, Allentown, PA	Denise_lawrence@lucent.com
Lowell Tomlinson	Lucent Technologies, Allentown, PA	l.h.tomlinson@lucent.com
Rick Bentson	Lucent Technologies, Allentown, PA.	rick_bentson@lucent.com
Tony Chong	National Semiconductor, Santa Clara, CA.	tony.chong@nsc.com
Gil Alcaraz	National Semiconductor, Santa Clara, CA.	gil.alcaraz@nsc.com
Eduardo Bernal	Texas Instruments	e-bernal@ti.com
Dan Wikander	Texas Instruments	d-wikander@ti.com
Maynard Eaves	H-P, Corvallis, OR.	maynard_eaves@hp-cv.cv.hp.com
Jennifer Hughes,	H-P, Corvallis, OR.	jennh@cv.hp.com
Naing Tinnyuntpu,	H-P, Singapore	naing_tinnyuntpu@hp.com
SEMATECH assistance:		
Olivia Miller-Snapp	Austin, TX.	Olivia.Miller-Snapp@sematech.org
Ann Gregg	Austin, TX.	Ann.Gregg@sematech.org

**SEMATECH Technology Transfer
2706 Montopolis Drive
Austin, TX 78741**

**<http://www.sematech.org>
e-mail: info@sematech.org**