



**International SEMATECH Manufacturing Initiative (ISMI) Equipment
Change Notification Method: Version 1**

**International SEMATECH Manufacturing Initiative
Technology Transfer #08074942A-ENG**

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Abstract: This document from the MFGM057M project outlines procedures and guidelines for equipment suppliers issuing equipment change notifications. The method is applicable to changes to semiconductor process and metrology equipment in a semiconductor production environment, specifically those related to equipment hardware, software, and calibration documentation. The method does not apply to ancillary test equipment or internal supplier/end-user change handling procedures and activities.

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1 EXECUTIVE SUMMARY

Based on the need for improved methods of change notification, the International SEMATECH Manufacturing Initiative (ISMI) created the Equipment Systems Configuration Management (ESCM) project in 2008. Its focus is to facilitate improved equipment change notifications from suppliers to end users.

Unknown changes to equipment after purchase or installation contribute to variability in production in the end users' fabs. In some cases, when changes are announced late, the lead times associated with the change leave no room for engineering action. Therefore, the ability of engineering managers to rapidly understand and disposition proposed equipment changes may be impaired. As a result, the ISMI Change Notification Method was developed to provide guidelines and procedures by which equipment suppliers can consistently issue change notifications.

The method is applicable to items affecting the safety, hardware, software, and calibration of semiconductor process/metrology equipment. Changes to new orders of the same model are included along with tools of record (i.e., baseline or golden tools). Items outside the scope of this document are ancillary test equipment, internal supplier change procedures, and end-user change disposition procedures.

The method includes guidelines and procedures designed to provide sufficient change information. As shown in Figure 1, the method comprises six major steps:

1. Supplier procedures defining the need for proposing equipment changes*
2. Initiation of a change notification
3. Change notification submission
4. Notification acknowledgement
5. End-user change notification disposition *
6. Final response from end user *

Value propositions associated with an optimized change notification system are as follows:

1. Reduction of unnecessary distractions between equipment suppliers and end users
2. Elimination of start-up configuration surprises
3. Acceleration of reliability improvements
4. Improved fleet matching upon delivery
5. Improved manufacturing readiness/start-up time, including hookup and qualification
6. One solution in which configuration changes can be communicated to multiple end users
7. Delivery of metrics for non-conformance

* Outside the scope of this method – included here as they are an integral step in the process

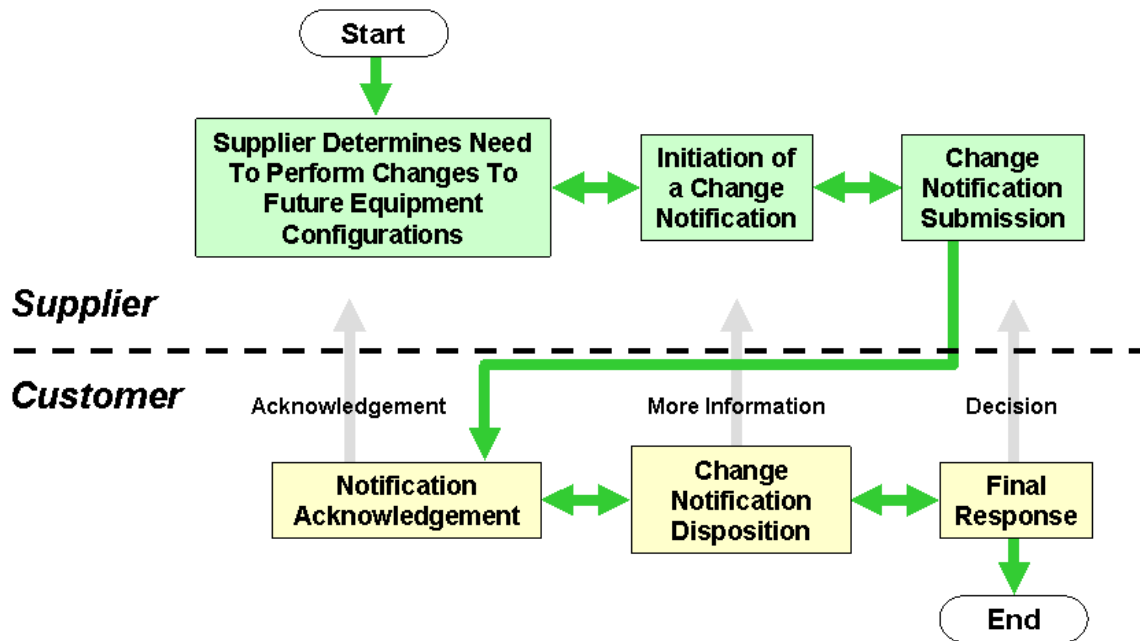


Figure 1 High-Level Change Notification Overview

The guidelines are summarized below:

1. Configuration Baseline – A listing of the equipment’s bill of materials, equipment constants, and gas box configuration.
2. Sufficient Change Notification Content – Detailed information to facilitate acceptance or denial of the proposed change by end users.
3. Definition of Change – Information on what constitutes a change.
4. Notification Lead Time – Advanced notice of the change. Depending upon the severity of the change, 3 to 6 months may be required.
5. Notification Identifier – A unique notification for all change notifications.
6. Test Recommendations – Procedures from the supplier citing the tests required to qualify the change.
7. End User Acknowledgement – Affirmation of receipt from the target contact person.
8. Anticipated Decision Date – A date by which the end user expects to agree or not agree to the change proposal.
9. Right of Refusal – The right of the end user to reject changes that may adversely affect production.

The mission of the ISMI Change Notification Method is to facilitate end-users’ disposition of changes proposed by equipment suppliers. The method does so by improving the content and consistency of change notifications. The ability of engineering managers to rapidly understand and disposition proposed equipment changes is key to the successful ramp-up and steady state optimization of equipment productivity.

2 PURPOSE

There are currently various methods by which suppliers can notify end users of impending parts changes, equipment modifications, and upgrades. In some cases, when the need for a part change is determined, limited discussions between suppliers and end users cause both to be unprepared for the change. Unknown changes are typically discovered during installation, increasing installation time when tools arrive with different configurations. After acceptance, it becomes difficult for end users to disposition changes related to process chambers that could negatively affect product.

As a result, the ISMI Change Notification Method was developed to provide guidelines and procedures by which equipment suppliers can consistently issue change notifications to end users. These methods are intended to improve the content and consistency of change notifications. The approach defines the change, documents the change, and provides sufficient background to support the need for the change. Successful deployment of these procedures should enable equipment suppliers to minimize the different types of possible change methods as well as the number of end users they must contact. End users should benefit from consistent levels of information as well as improved lead times, allowing them to properly disposition a specific change to equipment after its selection through its use in production.

This document describes how the basic processes shown in Figure 1 (within scope) will be performed. The methods and procedures are general enough to enable a broad application; they may be updated periodically to reflect requested modifications.

3 SCOPE

The method is applicable to items affecting safety, hardware, software, and calibration documentation, configured or associated with *new* semiconductor process/metrology equipment. All changes to new orders of the same model should be communicated—including baseline tools, golden tools, and tools of record (TOR)—when the change is made by the supplier, not just when a new tool is ordered.

Items considered outside the scope are as follows:

1. Existing equipment that has been accepted and qualified for production.
2. Ancillary test equipment (wafer sensors, leveling devices, software test programs, etc.).
3. Detailed supplier procedures defining the need for proposing equipment changes.
4. Detailed end-user change notification disposition procedures.

Note: Even though items #3 and #4 are considered out of scope, their higher level processes are included in Figure 1 because they are key steps in change notification; however, details are not prescribed by ISMI.

4 REFERENCE DOCUMENTS

Related documents are available on ISMI's website (www.ismi.sematech.org), while others (such as industry standards) are at www.semi.org. Information related to change notification and configuration management is listed below:

- *Equipment Systems Configuration Management (ESCM) – Change Notification Requirements Benchmarking Report*, TTID 32499TD
- SEMI E76, *Guide for 300 mm Process Equipment Points of Connection to Facility Services*, §8.2
- EIA-649-A, *National Consensus Standard for Configuration Management*, §5.3.1.3 Change Implementation and Verification, Principle 3-3A
- ISO 9000, *Quality Management Standard*
- ISO 10007:2003(E), *Quality Management Systems – Guidelines for Configuration Management*, §5.4 Change Control; Appendix A, §A.5 Change Control
- SEMI E120, *Specification for the Common Equipment Model (CEM)*
- CMDBf, *Configuration Management Database Federation* (BMC, CA, Fujitsu, HP, IBM, and Microsoft) – <http://cmdbf.org>

5 ABBREVIATIONS AND TERMINOLOGY

5.1 Abbreviations

The following acronyms are defined as they are used in this document. In some cases, a more general term may be defined in the context of the Change Notification Method.

ACR	–	Accepted Change Rate
BOM	–	Bill of Materials
ECs	–	Equipment Constants
ESCM	–	Equipment Systems Configuration Management
QAC	–	Quantity of Accepted Changes
QPC	–	Quantity of Proposed Changes
TOR	–	Tool of Record

5.2 Terminology

The following terms are defined as they are used in this document. In some cases, a more general term may be defined in the context of the Change Notification Method.

Accepted Change Quantity (QAC)

Quantity of the proposed changes accepted by an end user.

Accepted Change % (AC%)

The percentage ratio of accepted changes to changes proposed.
 (Accepted Change Quantity / Proposed Change Quantity) × 100

Affected Area

The manufacturing area (e.g., CVD, etch, etc.) that is directly affected by the proposed change.

Affected Equipment Model Number

The equipment model number(s) directly affected by the proposed change. This information is obtained from the supplier.

Affected Machine

Equipment in the supplier's build cycle that are affected by the proposed change.

Change Category

The category (parts change, software change, affect assembly, maintenance, operating, alignment procedures, or other) of the proposed change.

Configuration Baseline

A baseline listing of all parts and software that make up the current or target system or equipment.

Cost Impact

Added cost to capital equipment and/or cost of ownership.

Customer Contact

Name of the end-user contact responsible for the receipt of a specific change notification.

Delivery Date Affected

The delivery date of a new equipment or subsystem, currently in the build cycle, which is affected by the proposed change.

Effective Date

Date, at the supplier's site, when the proposed change is scheduled to be performed.

Interchangeable Part

A part that can be ordered from existing stock without the need to modify its higher level subsystem.

New Part Number

The part number proposed as a replacement for an existing part number.

Notification Lead Time

The time of notification distribution before the effective date of the proposed change.
 (Notification Lead Time = Change Date (proposed) – Notification Distribution Date)

Old Part Number

The part number in the existing configuration baseline that is proposed for replacement.

Optional Change

A change that may not have to be performed to ensure safety and performance.

Origination Date

The date when a specific change notification is originally distributed to an end user.

Originator E-Mail

E-mail address of the person responsible for distribution of a specific change notification.

Originator Name

Name of the person responsible for distribution of a specific change notification.

Parts Change

The replacement of a physical or software element within a system configuration.

Note: In this context, “logical” software (i.e., EFEM, system drivers, etc.) entities are not to be included.

Proposed Change

A change request distributed to a customer for system modification.

Proposed Change Quantity (QPC)

Number of changes proposed by a supplier to one end user.

Proposed Change Reason

The supplier’s motivation or necessity for the proposed change.

Risk Level

The relative severity of the proposed change based on the impact to tool operations. Detailed descriptions of the expected or potential risks must be included.

6 DESCRIPTION OF THE CHANGE NOTIFICATION METHOD

6.1 Overview

The ISMI Change Notification Method includes guidelines and procedures designed to provide sufficient change information to end users of semiconductor processing and metrology equipment. As described in Figure 1, there are six major steps:

1. Supplier Procedures Defining the Need for Proposing Equipment Changes
2. Initiation of a Change Notification
3. Change Notification Submission
4. Notification Acknowledgement
5. End User Change Notification Disposition
6. Final Response

Note: Items #1, #5, and #6 are outside the scope of this method, but they are included because they are integral steps in the change notification process.

Use of the method should allow suppliers to perform the following actions:

- Submit change notifications in a standardized format
- Submit a change notification complete with sufficient content
- Direct the notification to the appropriate companies
- Direct the notification to the appropriate individual(s), including engineering and purchasing (at a minimum)
- Determine if further communications are required

The method should also allow end users to perform the following actions:

- Receive change notifications in a standardized format with sufficient content
- Direct the notification to the appropriate individual(s)
- Determine if further information is required to support the proposed change
- Disposition the proposed change in minimal time

6.2 Value

The value provided to suppliers and end users by the ISMI Change Notification Method is considered broad. Specific value propositions are as follows:

- Reduce unnecessary distractions between equipment suppliers and end users
- Eliminate start-up configuration surprises
- Accelerate reliability improvements
- Improve fleet matching upon delivery
- Improve manufacturing readiness/start-up time, including hookup and qualification
- Allow suppliers one solution in which configuration changes can be communicated to end users
- Deliver metrics for non-conformance

6.3 Desired Outcomes of a Change Notification

The following are target outcomes of a change notification:

- Suppliers send fewer notifications as a result of a standardized notification procedure
- End users get sufficient information such that disposition loops are fully enabled
- Improvements of selected metrics can be tracked

7 CHANGE NOTIFICATION GUIDELINES

To better understand the items that make up a valid change notification, nine guidelines are provided:

1. Configuration Baseline
2. Sufficient Change Notification Content
3. Definition of Change
4. Notification Lead Time
5. Notification Identifier
6. Test Recommendations
7. End-User Acknowledgement
8. Anticipated Decision Date
9. Right of Refusal

7.1 Configuration Baseline

Any change to a new system is based upon an existing list of materials. To support end-user disposition procedures, a baseline configuration is required. This baseline should provide the following:

- Equipment bill of materials (BOM), pertinent to the risk levels 1 and 2 (see Appendix C), whether defined by the end user or from the actual BOM from the supplier
- A listing of configured equipment constants (ECs)
- A description of the equipment's gas box configuration

7.2 Sufficient Change Notification Content

Information related to the proposed change should be provided with sufficient content to allow the end user to disposition the change. Items labeled as “Entry” in the Action Type field of Table 2 must be provided with a change notification.

7.3 Definition of Change

A change can be defined as any change to the existing build configuration of previously purchased tools or a change to any component of the build configuration. The type of change is further classified by the potential risk to the outcome of the product and is defined in Appendix C.

Note: The build configuration is defined by the BOM.

7.4 Notification Lead Time

Proposed change notifications, pertinent to risk levels 1 and 2 (see Appendix C), should preferably be submitted 3–6 months in advance of the proposed change date. Note: The location of the change (front end of line, etc.) and risk levels may affect the ability of suppliers to provide sufficient lead times.

7.5 Notification Identifier

A unique notification identifier must be supplied with any change notification to track the notification.

7.6 Test Recommendations

The supplier should cite the minimum specific tests that should be used to qualify a candidate change. Additional tests to monitor the impact of the change should also be supplied. Note: This guideline is limited to risk level 1 and in some cases risk level 2.

7.7 End-User Acknowledgement

Upon receiving a change notification, the notified party should immediately acknowledge its receipt.

7.8 Anticipated Decision Date

In the notification acknowledgement, the end user should communicate an anticipated decision date to the supplier.

Note: In some cases, acceptance may be assumed if no response is provided to the supplier within 30 days of its initial distribution.

7.9 Right of Refusal

An end user reserves the right to reject any change that may adversely affect production given valid test results.

Note: Exceptions would be related to safety and obsolescence.

8 CHANGE NOTIFICATION EXECUTION

Change notifications should include enough information for end users to disposition the proposed changes to systems in the field.

As a specific change notification progresses, extensive analyses and impacts of the proposed change will be determined. In some cases, several months may pass before the change is approved. If extensive qualifications are required, both parties should meet to plan the activity. If a decision is made to disallow the proposed change, all factors contributing to the decision should be identified, captured, and documented.

8.1 Procedures

Several steps are required for a robust change notification. They may require secondary documentation or communication. However, the intent of these procedures is to provide the structure by which the primary content of a change notification is submitted.

In addition to the decision on the planned date of the proposed change, an internal supplier process must be used to decide upon several other aspects of the proposed change. Those decisions, along with the planned date, must be populated into the change notification interface. Table 1 lists the decisions required to support an informational change notification.

Table 1 Supplier Decisions to Support Adequate Information for a Change Notification

Item	Decision Type	Decision
Change Date (proposed)	Date	Determine the date when the supplier plans to implement the change.
Affected Area	Identification of Equipment Class Affected	The supplier must determine the equipment class directly affected by the proposed change (CVD, dry etch, photo, etc.)
Affected Model(s)	Identification of Equipment Model(s) Affected	The supplier must determine the equipment models directly affected by the proposed change
Machines Affected	Identification of Machines Affected	The supplier must determine if any tools that are in the build cycle that are affected by the proposed change. This would allow end users to decide how to handle the change; either on the vendor production floor, or when it arrives at the end users factory.
Change Category	Identification of Change Category	The supplier must determine the Change Category from the following seven categories: 1) Parts change; 2) Software change; 3) Affect assembly or facility connections; 4) Maintenance; 5) Operating; 6) Alignment procedures; and 7) Other. See Appendix B for detailed information.
Risk Level	Identification of Risk Level	The supplier must decide on the risk level of the proposed change. See Appendix C for detailed information.
Optional Change?	(Yes or No)	Determine if the proposed change is optional or if it must be performed to ensure equipment safety and performance.
Parts Change?	(Yes or No)	Determine if a parts change is required, which would include software changes, modifications, and upgrades. Also, any changes to existing calibration documentation should be noted.
Interchangeable?	(Yes or No)	Determine if a proposed parts change can be ordered from existing stock without having to separate it from old parts.
Delivery Date Affected?	(Yes or No)	Determine if a delivery date is affected by the proposed change. NOTE: This item is limited to new equipment or subsystems.
Cost Impact?	(Yes or No)	Determine if there is a cost impact to the capital cost and/or the COO.
Safety Issue?	(Yes or No)	Determine if there is a safety issue related to the proposed change.
Additional Training required?	(Yes or No)	Determine if additional training is required as a result of accepting the proposed change.
Facilitization Change?	(Yes or No)	Determine if a facilitization change is required as a result of accepting the proposed change.
One-to-one or one-to-many notification?	Identification of the number of customers to notify	Two methods of notifications are possible: a communication from a supplier to a single customer or to multiple customers at one time. It is up to the supplier to determine which method should be used based upon the targeted equipment and the specific situation.

Conversely, the notified end user must also make certain decisions based on the information in the change notification. Other than a request for more information to support the change notification, change notification disposition procedures are outside the scope of this document except for the acceptance/denial notification.

Table 2 outlines the procedures, assuming changes must be made to new equipment models after tool selection. Therefore, the procedure begins with a decision on the planned date of the proposed change.

Table 2 Procedures for Entering Information into a Change Notification Portal for Submission to an End User

Step	Description	Comments	Action Type	Responsibility
8.11.1	Initiate a Change Notification	To initiate a proposed change, access an electronic version of the template present in Appendix A.	Notification Portal Access	Supplier
8.11.2	Enter Supplier Name	The name of the supplier company should be entered in the notification portal.	Entry (via a notification portal)	Supplier
8.11.3	Enter the Origination Date	The date when the change notification was originally submitted to the targeted end users.	Entry	Supplier
8.11.4	Enter the Originator E-Mail	The email address of the supplier contact responsible for change notifications.	Entry	Supplier
8.11.5	Enter Customer Contact(s) E-Mail	The email address of the customer contact responsible for change notifications.	Entry	Supplier
8.11.6	Enter the Affected Area	Enter the affected area (CVD, dry etch, photo, etc.) into the change notification portal. Note: If multiple areas are indicated, this may require sending the notification to multiple contacts.	Entry	Supplier
8.11.7	Enter the Affected Model(s)	Enter the affected model into the change notification portal.	Entry	Supplier
8.11.8	Enter the Change Category	Input the change category associated with the change.	Entry	Supplier
8.11.9	Enter the Risk Level	Input the risk level (1, 2, or 3) associated with the change. Reference Appendix C for details. Note: Change notifications indicating a risk level 1 or 2 require internal review by the end user. For example, wafer path, process control system, and facilities hookup affected changes are considered high risk and may require qualification.	Entry	Supplier
8.11.10	Enter a Proposed Change Description	Provide a description of the proposed change.	Entry	Supplier
8.11.11	Enter a Proposed Change Reason	Provide a reason for the proposed change. Reference Appendix D.	Entry	Supplier
8.11.12	Describe the Proposed Change Reason	Enter a description of the reason or motivation for the proposed change.	Entry	Supplier
8.11.13	Optional Change? (Yes or No)	Enter a "Yes" or a "No" to verify that the change is or is not optional.	Entry	Supplier
8.11.14	Parts Change? (Yes or No)	Enter a "Yes" or a "No" to verify that a parts change is or is not required.	Entry	Supplier
8.11.15	Enter Parts Change Comments	If necessary, provide comments associated with the parts changes. If there is a part change, the notification should describe if it is compatible with parts in current toolsets.	Entry	Supplier

Step	Description	Comments	Action Type	Responsibility
8.11.16	Enter Old Part Number	If a parts change is indicated in the Category field, the notification must include the old part number affected by the proposed change.	Entry	Supplier
8.11.17	Enter New Part Number	If a parts change is indicated in the Category field, the notification must include the new part number affected by the proposed change.	Entry	Supplier
8.11.18	Interchangeable? (Yes or No)	Enter a "Yes" or a "No" to allow the end user to understand if proposed parts change can be ordered from existing stock without having to separate it from old parts. NOTE: If the proposed change is significant, end users typically must handle the part differently until existing stocks are depleted.	Entry	Supplier
8.11.19	Enter Effective Change Date	If a parts change is indicated in the Category field, the notification must include an effective change date.	Entry	Supplier
8.11.20	Delivery Date Affected? (Yes or No)	Enter a "Yes" or a "No" to verify that a delivery date (new equipment or subsystem) is affected by the proposed change. NOTE: This item is limited to new equipment or subsystems.	Entry	Supplier
8.11.21	Cost Impact? (Yes or No)	Enter a "Yes" or a "No" to verify that a cost impact will be realized as a result of performing or not performing the proposed change.	Entry	Supplier
8.11.22	Enter Cost Impact comments	Enter any comments related to the cost impact of the proposed change.	Entry	Supplier
8.11.23	Safety Issue? (Yes or No)	Enter a "Yes" or a "No" to verify that there is or is not a safety issue related to the proposed change.	Entry	Supplier
8.11.24	Enter Safety Issue comments	Enter any comments related to the safety impact of the proposed change.	Entry	Supplier
8.11.25	Additional Training? (Yes or No)	Enter a "Yes" or a "No" to verify that additional training is required as a result of accepting the proposed change.	Entry	Supplier
8.11.26	Enter Additional Training comments	Enter any comments related to the training impact of the proposed change.	Entry	Supplier
8.11.27	Requires Facilitization Change? (Yes or No)	Enter a "Yes" or a "No" to verify that a facilitization change is required as a result of accepting the proposed change.	Entry	Supplier
8.11.28	Enter Facilitization Change comments	Enter any comments related to any facilitation impacts that may result from acceptance of the proposed change.	Entry	Supplier
8.11.29	Attach additional information files	Attach any files, drawings, memorandums, etc., that may help describe the proposed change.	Entry	Supplier

Step	Description	Comments	Action Type	Responsibility
8.11.30	Distribute a one-to-one or one-to-many Change Notification	Two methods of notifications are possible, a communication from a supplier to a single customer or to multiple customers at one time. It is up to the supplier to determine which method should be used based upon the targeted equipment and the specific situation. The notification should be distributed to the appropriate contacts at the companies affected by the proposed change.	Send via portal	Supplier
8.11.31	Send a Notification Acknowledgement	Upon the receipt of a change notification, the notified party should immediately acknowledge the receipt of the notification. The acknowledgement should state the receiver's name, email address, phone number, and the expected time (anticipated decision date) in which a disposition will be made against the proposed change. This can be manual via an e-mail, or configured into an automated system. Note: In some cases, acceptance may be assumed if no response is provided to the supplier within 30 days of its initial distribution,	E-Mail	Customer
8.11.32	Send a request for more information to support the original change notification	The end user must determine if more information is required to support its internal disposition of the change notification. The correct notification identifier must be supplied with the request for additional information.	E-Mail	Customer
8.11.33	Disposition the Proposed Change	The internal process subsequent to a change notification is composed of two types of dispositions: Semi-automated process that requires an end-user company contact to initiate a voting loop within that company Automated review process within the end user's company Note: The two types of responses should not be confused with the Notification Acknowledgement described in 8.11.31.	Decision	Customer
8.11.34	Customer Final Response	According to guideline 7.7, an end user reserves the right to reject any change proposed to equipment after selection.	E-Mail	Customer

8.2 Metrics for Evaluation

The following metrics can be used to evaluate the performance of change notifications:

- Proposed Change Quantity (QPC) – a monthly count of the changes proposed by a supplier to one end user
- Accepted Change Quantity (QAC) – a monthly count of the proposed changes accepted by an end user
- Accepted Change Percentage (AC%) – QAC/QPC

9 SUMMARY

The mission of the ISMI Change Notification Method is to facilitate the end user's disposition of changes proposed by equipment suppliers. The method does so by improving the content and consistency of change notifications. The ability of engineering managers to rapidly understand and disposition proposed equipment changes is key to the successful ramp-up and steady state optimization of equipment productivity.

Appendix A – Example of Information Provided in a Detailed Change Notification

From: Christal, Lorn
Sent: Wednesday, June 18, 2008 7:16 AM
To: person@chipmaker.com
Cc: otherperson@chipmaker.com
Subject: Vendor Change Notification

EXAMPLE ONLY

This is an email notifying you and your company of an update to a tool in your fab.

Details are as follows:

Report Number: 26063.7873499
Company Name: ABC
Origination Date: 6 Jun 2008
Originator Email: lorn.christal@ismi.sematech.org
Areas: Etch (Dry)
Affected Models: Symphony 3 Models
Risk Level: Level 1
Category: Hardware
Proposed Change Description: AE Generator redesign for Kyoto, Kyoto 45, Kyoto 3x, Kyoto 45
Proposed Change Reason: Obsolete
Proposed Change Reason Description: A component used inside the AE generator is obsolete and no longer available.
Proposed Change Optional?: No
Parts Change Involved?: Yes
Parts Change Comments: Continue to use material on hand. Replenish with new part number. Three part numbers have been replaced by two.
Old Part Number: 660-032596-013, 660-032596-014, 660-032596-023
New Part Number: 660-032596-213, 660-032596-214
Interchangeable?: Yes
Machines Affected: No
Effective Change Date: 9/8/2008
Delivery Date Affected?: 11/8/2008
Cost Impact?: No
Cost Impact Comments:
Safety Issue?: No
Safety Issue Comments:
Needs Additional Training?: No
Additional Training Comments:
Requires Facilitation Change?: No
Facilitation Change Comments:

Appendix B – Change Categories

Any proposed change typically will fall into a specific category or type, as follows:

1. Parts change
2. Software change
3. Affect assembly
4. Maintenance
5. Operating
6. Alignment procedures
7. Other

Appendix C – Risk Levels

Certain types of equipment changes pose more risk to production. For notification, the risk levels of equipment changes are described below:

Risk Level	Description and Possible Effect	Typical Risk Vs. Reward Considerations	Examples of Changes
1	Anything that the wafer touches or is exposed to, as well as parts and software that may have the potential to change the electrical results (yield/parametric)	Changes to process performance. Effects on transferability cost and time of change or conversion. Effects on host software cost and effects on spare parts inventory	Process module changes materials within the process modules operating software that changes the process control systems, wafer movement or timing chemical, gas, RF or power delivery to process module facilities hook-up/layout sub-assemblies controllers (dose controller Implant, gas panel controllers, etc)
2	Possible effects on productivity (throughput, uptime, etc.) or any ongoing cost. Also any external environmental/abatement changes.	Changes to process performance. Effects on transferability cost and time of change or conversion. Effects on host software cost and effects on spare parts inventory	Software change for bug fixes. Liquid or gas delivery components (MFC, LFC, valves) Process module pumps and changes to support equipment. Wafer handling systems and components safety and environmental issues in situ monitoring electrical grounding/shielding computer, communications, firmware material cleaning load locks and staging modules changes in manufacturing process (main tool build or subassembly components)
3	Minor changes (i.e., nuts, bolts, or paint) that have no electrical or cost effects.	Limited risk concerns	Nuts/bolts/brackets; aesthetics and system finish subassembly layout changes that do not cause facility changes material changes outside the process module rigging and tooling requirements (for installation)

Appendix D – Proposed Change Reasons

Reasons for proposing changes to equipment after selection or while in production are as follows:

1. Obsolete
2. Safety
3. Supplier Change
4. CIP (performance, continuous improvement, etc.)
5. Procedural
6. Cost

Appendix E – Document Change History

No.	Change Notification Method Version	Change Type (i.e., Addition, Deletion, etc.)	Section Number and Title	Description of Change
	Version 1	Initial release	All	July 2008 – Initial release

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