**Purpose:**

 To define the preventive maintenance activities required for process equipment used during the manufacture of PCB product to ensure and maintain product quality.

**Responsibilities:**

It is the responsibility of the Preventive Maintenance Technician and the Quality Manager to maintain this procedure.

It is the responsibility of the Preventive Maintenance Technician to effectively implement and comply with the requirements of this procedure. It is also the responsibility of the Preventive Maintenance Technician to notify a supervisor to reorder missing, expired, or broken consumable parts, filters, etc., that are needed in that specific department. The PM technician is also responsible to confirm that such items have been reordered and replaced.

 It is the responsibility of manufacturing Product and Support Group Supervision to monitor equipment inventories in conjunction with QA PM Technician to ensure that all equipment and required services are kept current for PM Database control. If ever performance of internal Preventive Maintenance falls below the PCB Goal of 95% completion, the responsible Supervisor shall provide to the PM Technician Assignable Cause for the deficiency. Supervision shall notify PM Technician whenever equipment status or requirements change. Groups are also responsible for continuing performance of any specialized PM Services that must be performed internally by department personnel.

 It is the responsibility of manufacturing Product and Support Group Supervision to ensure that any equipment found to be defective, or capable of producing detrimental effects upon PCB product, be removed from service until sufficient repair or replacement. If an Out of Tolerance condition is cited by a QA074, Preventive Maintenance Out of Tolerance Equipment Evaluation form, the equipment owner must evaluate any potential effects that the condition may have had on process or product.

 It is the responsibility of Assembly and Calibration Technicians to maintain all tools, equipment and work areas associated with their jobs in proper working conditions, as defined by related procedures.

**Affected Department / Product Group / Support Group:**

 **Departments**: Engineering, Manufacturing

 **Product Groups**: Pressure, Force and Torque, Vibration, IMI Sensors, Electronics and Cables, North Carolina

 **Functional Support Groups**: Logistics, Microelectronics, Machine Shop, Quality Assurance, Hermetic Connectors, Crystal Manufacturing, Repairs, Welding and Etching.

**Associated Documents:**

 ISO-9001, ISO17025, AS9100, Directive 94/9/EC (EN13980), Quality System Manual (QSM), Quality Assurance Manual (QAM), Express Maintenance Preventive Maintenance Database.

**Scope**:

 This procedure defines the responsibilities of the Preventive Maintenance Technician to ensure that Preventive Maintenance is completed as scheduled throughout the PCB Product Groups and Support Groups, and record of its completion is accurately maintained in the Express Maintenance Database. When any critical items or process control characteristics, resulting from Design and Development output, require Preventive Maintenance system support,ie: fixtures, the engineer and/or manufacturing representative shall advise the Preventive Maintenance technician for entry of supporting Preventive Maintenance requirements in PM database.

 The Preventive Maintenance Technician will not be responsible for personally performing Preventive Maintenance activities to equipment, or within areas, where specialized skills, knowledge or training are required, including, but not necessarily limited to, the Machine Shop, Laboratories and the General Building Utilities. This will also include “building equipment” such as roof top AC units, heating, emergency generator, etc. Additionally, any scheduled departmentally implemented Preventative Action activity will continue to be performed by the appropriate Department representative.

 The specific Departmental Supervisor and the Quality Assurance Manager are responsible for defining the scope of the PM Technician responsibilities pertaining to any specialized situations.

**Procedure:**

**Entering New Equipment**

Select from the Main Menu: **Maintenance→Units**

1. Click the Plus Sign (+) to enter new equipment.
2. Enter at minimum:
	1. Name (If the item is included in the PCB Calibration System, include the Asset Number from the attached Identification / Calibration label)
	2. Model
	3. Serial #
	4. Site / Location
3. Click the “Services (PMs)” tab
	1. Click the Services Drop Down
		1. Select an existing Service, or select <Manage Services>, to enter a new service.

NOTE: New entries can be added to any Drop Down list using the <Manage ….> selection method.

* + 1. Enter at minimum:
			1. Service Name
			2. Period
			3. Interval.
			4. Work Group to perform the Service (“Quality Assurance” or “Internal”).
		2. PM Service, Period and Interval should be established per OEM manuals, Manufacturer’s recommendations, intended use, criticality of the process, etc.
1. Click the “Notes “ tab. Enter any General or Safety related information associated with the piece of equipment for future reference.
2. When all desired entries are complete, click the Post (√) icon to save.
3. Click the Cancel (**X**) icon to discard entries.

**Editing Existing Equipment or Services**

Select from the Main Menu: **Maintenance→Units**

1. Click the **Overview** Tab.
2. Enter the first few characters of the equipment Name into the Quick Position field, until the desired piece of equipment appears highlighted in the list.
3. Double Click the desired piece of equipment to go to the Units screen.
4. Click the appropriate Edit (▲) icon to edit the Equipment or its Services.
5. Click the appropriate Add (**+**) icon to add new Equipment or Services.
6. Click the appropriate Delete (**-**) icon to delete a piece of Equipment or a Service.
7. When all desired edits are complete, click the Post (**√**) icon to save.
8. Click the Cancel (**X**) icon to discard entries.

**Entering PM Performance**

Select from the Main Menu: **Maintenance→Units**

1. Click the **Overview** Tab.
2. Enter the first few characters of the equipment Name into the Quick Position field, until the desired piece of equipment appears highlighted in the list.
3. Double Click the desired piece of equipment to go to the Units screen.
4. Highlight the Service to be performed.
5. Click the “Service Notes Dialog” icon (the Notepad with Red Dot) to access any presaved Testing Instructions or comments specific to that Service. Record any data specific to the Service performance (eg: measured values, conditions, comments or deviation rationale) that may be useful as future reference.

1. To access any Attached procedure or document click the “Attachments” tab.
	1. Click the “Execute / Jump To” Icon above the attached procedure to open the document.
	2. Close the attachment and Return to the “Services (PMs)” tab to enter the PM completion.
2. To perform the service, click the **Complete** button.
	1. Enter at minimum:
		1. Completion Date.
		2. Performed By.
	2. Click **OK.**

 **Adding Attachments**

1. Open the record for the Unit desired.
2. Click the “Attachments “ tab. Click the Plus Sign (+) to enter new record.
3. Highlight TYPE and select “File”. Highlight the REFERENCE box to browse for the appropriate document.
4. Double-click the file to be attached,.
5. In the “Description” field enter the Name or appropriate identification of the attachment.
6. Click the (**√**) icon to Post and Save the attachment.

**OOT Equipment**

If a test or inspection is required for a scheduled PM Service, the PM Technician, or responsible internal employee performing the service, must verify that the equipment meets stated requirements and/or tolerance. Any equipment found to be operating outside of required conditions must be taken out of service or corrected and the actions documented. Condition and correction shall be recorded for inclusion in the PM Database rationale. After any adjustment or repair is performed, the equipment or condition in question shall be again measured by the PM Technician, to verify that effective correction has taken place prior to use. Additionaly, if the equipment is identified by a Calibration Sticker as an Asset controlled by the Calibration Database, it must be recalibrated by the QA Calibration Department prior to use.

* + - 1. Items not critical to process or product quality, routinely and easily repairable, found to be operating outside of required conditions, may be corrected or repaired upon approval by the responsible area Supervisor.
			2. Any physical or environmental condition, such as floor resistance or air cleanliness, found not to be as required or expected must be reported to the area Supervisor for their immediate action.
			3. Any piece of equipment whose OOT condition may have had an effect on process or product quality must be reported to the area Supervisor in writing via a Preventive Maintenance Out of Tolerance Equipment Evaluation form QA074.

**QA074 OOT Documentation**

1. The PM Technician shall complete all applicable information in Section 1 and forward QA074 to the Supervisor responsible for the OOT equipment. Ensure that the Description of Malfunction or OOT Condition is comprehensive and detailed as to provide effective evaluation of the issue.
2. The Department Supervisor / Manager shall complete Sections 2. The OOT condition must be evaluated to determine what, if any, effects it may have had on processes or products. Proper Root Cause Analysis shall be performed, and the Corrective / Preventive Actions taken should consider the last date that the piece of equipment was known to have been functioning within tolerance.
3. Nonconforming equipment must be identified and removed from service by the area Supervisor, until required repairs or adjustments are complete. During this time, the Supervisor must ensure that equipment is identified as non-compliant and can not be used, by attaching a copy of QA074 to the item. If replacement equipment is necessary, the area supervisor must notify the PM Technician for its addition to the PM Database.
4. Upon completion of repair or replacement, the Supervisor shall notify the PM Technician. The proper function of the equipment in question must be verified, and any actions taken approved, by the PM Technician before the unit can be returned to service. Additionaly, if the equipment is identified by a Calibration Sticker as an Asset controlled by the Calibration Database, it must be recalibrated by the QA Calibration Department prior to use.
5. The PM Technician initiates Section 3 of Form QA074 to signify confirmation that appropriate actions were taken, and that the OOT condition was corrected, and submits form to the Quality Assurance Manager for final approval of the situation. If either party disapproves of the actions described, the form shall be returned to the previous signee.
6. PM Technician shall revise the PM DB, as necessary to account for any equipment changes that resulted from the OOT incident. If necessary, verification frequency should be decreased sufficiently to ensure that Corrective Action remains effective. Details of the equipment failure, Corrective Actions taken and any verification frequency rationale shall be documented in the Unit or Service Notes.
7. It is the responsibility of the PM technician to oversee the completion of the QA074 form. Upon completion, the form shall be scanned to the R:\Quality\Preventive Maintenance\Records - QA074 OOT Forms directory, and entered into the database as an attachment to the appropriate unit.

**Reports**

\*NOTE: When utilizing the PM database report generator, the employee shall enter a beginning date (“from” date) of at least one year earlier from the end date (“thru” date) to ensure effective database monitoring. PM Technician must monitor the PM Database, using the reporting functions as needed, to allow scheduling of workload to ensure effective completion of all PM services. Various preformatted or customized reports may be generated as needed. At minimum, the PM Technician must monitor and/or report weekly, any Overdue or Upcoming PM services to ensure that services are performed as scheduled. Weekly reports of any upcoming PM Services scheduled for performance internally by Product Groups are printed and distributed to the involved Groups to announce the upcoming due dates.

 General

 To access the Reporting functions, Select from the Main Menu: **Maintenance→Reports.**

1. To produce a report to list all PM Services sorted by scheduled due dates, selectable by date range Set “Use Date” dropdown box to **Scheduled Date**.
	1. Enter a “From Date”, from the dropdown box Calendar, to set the beginning of the date range to be queried.
	2. Set “Thru Date” dropdown to set the end date to be queried
2. Select **Scheduled Date** to “Ignore Dates” for a report of all scheduled Services independent of date.

 **Note:** It is advisable to run periodic reports that Ignore Dates to ensure that no PM services were missed prior to the current reporting period.

1. Select a specific Product Group or Department from the “Site” and “Location” dropdowns if only one area is of interest, or leave as **<All>** to report Work Group activities for all areas of that “Site”.
2. Set appropriate Workgroup, as required, to select services assigned for performance by responsibility.
	1. PM Technician designated responsibilities are selectable by setting Work Group to “Quality Assurance”.
	2. Product Group designated responsibilities are selectable by choosing the Work Group that corresponds to the desired Department/Production Group.

**Note:** In the case of the appropriate Work Group not existing, contact IT to add in the Work Group code to Express Maintenance, or get approval for Administrative Privileges to access the Code Management tool in the system.

**Note:** Reports for “Locations” in any facility without the selection of a Work Group will show every PM Task assigned to that Location, regardless of what Work Group it is assigned.

1. Select a desired report from the right window of the Dialog Box. Examples are:
	1. “Services – Scheduled by Date”, lists all PM Services sorted from earliest due to latest due.
	2. “Services – Days Until Due”, lists all PM Services sorted by calculated Scheduled Date – Current Date.
	3. “Services – Scheduled by Dept.”, lists all PM Services with a Date Performed / Signoff area for recording PM performance.
2. Print report as required.

Weekly Scheduled Maintenance

The weekly schedules for Internal Departmental PM, shall be printed and distributed each Monday morning, as soon as possible after all previous week’s performance has been entered. All efforts should be made to allow departments as much time as possible to perform all weekly requirements.

1. Set “Use Date” dropdown box to **Scheduled Date**.

1. Enter a “From Date”, from the dropdown box Calendar, predated to one year prior to the “From Date” to capture any services that may be potentially overlooked.
2. Set “Thru Date” dropdown to the following Sunday to ensure that any Service scheduled for the weekend is included.
3. Select a “Site” from the dropdown menu. No “Location Filter” is required for weekly maintenance sheets.
4. Select a “Work Group” according to QA145 – Preventive Maintenance Sheet Tracker, available on TCS.
5. Select the desired “Services – Scheduled by Dept.” report. This report type advises departmental PM representatives of all the PM Services currently due and lists instructions for timely return of the report to the PM Technician.
6. To support legitimacy of PM Metrics data and keep track of weekly Preventive Maintenance task sheets, the amount of tasks, their status, and amount of uncompleted tasks shall be recorded with use of the QA145 – Preventive Maintenance Sheet Tracker. The template for this worksheet can be found on TCS. It shall be saved in the appropriate folder for year and month, and named after the date of the Monday starting the week, I.E. “10/30/17”, or “11/6/17”. Referrence CS002 for this document’s storage.
7. For ensurance that PMC (Machine Shop) PM data is accurately collected for the Metrics, run a report using Site, “PCB PMC”, no Location field, and form “Services – Scheduled by Dept. TFC”. The workgroup selection should be left blank, additionally. Record the amount of tasks in the PM Metrics. On the following Monday, run this same report to ensure all tasks were completed, finish the listing, and record the next week’s amount of tasks as previously instructed.

Tracking Out-of-service Items

 Select from the Main Menu : **Maintenance → Reports**.

1. Select “<Ignore Dates>” in the **Use Date** field.
2. Select the “Temporary Out Of Service” Site filter from the dropdown menu.
3. Run the desired report.

**Maintenance Service and Interval**

Recommended Preventive Maintenance Services and required service intervals for common pieces of equipment have been established per Manufacturer recommendations, equipment history and/or process criticality. These intervals are based on calendar time or mechanical counters. Required maintenance services may be added to or removed from a piece of equipment per the equipment owner, provided approval is granted from PM technician and/or department manager. Occasionally equipment can not be serviced on scheduled date due to testing in progress, or equipment in use for production purposes. When this happens, any equipment not checked on due date will appear on the following weeks’ PM report to be checked. Rationale for extension of service performance must be documented in the applicable Service Notes section of the PM Service.

A performance interval may be shortened as required to assure continued effective maintenance as evidenced by the results of preceding services, equipment performance and/or owner request. The interval of performance may be lengthened when the results of previous history provide indications that such action will not adversely affect the accuracy of the system. Rationale for any interval change must be documented in the Service Notes for the applicable service. Rationale for lengthening of a service interval, or removing a service, must be supported by evidence that the change will not negatively affect the Unit or the process in which it is involved. Notes should always explain the logic behind making the determination. Avoid general statements that can not be supported by data. Any supporting documentation, such as statistical analysis or calculations, shall be attached to the unit record using the “Attachments” function.

When equipment is purchased second hand or manuals are not available, the Preventive Maintenance Technician will try to find recommended maintenance instructions via searching Internet or contacting manufacturer.

**Equipment Inventory**

1. It is the responsibility of Supervisors / Managers / Engineers to notify the PM Technician whenever new equipment requiring PM services is purchased, or the status of an existing piece of equipment has changed.

**New Equipment**

New equipment identification and service requirements shall be documented on the PREVENTIVE MAINTENANCE PROGRAM: EQUIPMENT INFORMATION SHEET, QA116, by the responsible Engineer and/or Supervisor and submitted to the PM Technician for entry into the PM Database. All available information should be filled in on QA116 to thoroughly identify the equipment and define its maintenance requirements.

**Existing Equipment**

 The PM Technician, and the QA Calibration Department if necessary, must be notified whenever equipment status, or the need for maintenance service, changes. Updates to existing equipment may be communicated to the Technician by noting changes when returning the weekly Services - Scheduled by Dept. report. Rationale for any revisions must be included for documentation by the PM Technician. Notification is required when:

* 1. existing equipment is moved to a new location,
	2. existing equipment is removed from or returned to service,
	3. existing equipment PM needs or service frequencies have changed.

2. Any necessary maintenance or testing required on equipment moved to a new location must be done prior to its ` use, to ensure there was no damage to the equipment in the move and that setup has been done properly.

3. If during normally scheduled service performance the PM Technician encounters any unreported equipment additions, changes or deletions, as listed above, the Supervisor shall be notified to provide information concerning any services that are required.

4. Quarterly investigations within individual production departments are scheduled for the PM Technician to ensure that all equipment and services are adequately controlled.

5. The PM Technician shall update the Express Maintenance Database as required, concerning any new equipment additions or service changes, upon notification. Any rationale pertaining to the revisions shall be noted.

**External Group PM**

PCB Machine Shop / PCB NC

Preventive Maintenance performance within these areas, and its documentation in the Express Maintenance Database, is managed independently from the responsibilities of the QA Preventive Maintenance Technician. The PM Technician may support the efforts of these through notification of any negative or unusual trends discovered through routine monitoring of service performance throughout Database and/or the reporting of shared metrics.

Product Group Internal PM

Certain Preventive Maintenance services within the PCB Depew location must be performed by qualified internal employees, due to the need for specialized skills, knowledge, training or equipment access. While the physical performance of the maintenance activities must be carried out internally, the monitoring, notification and documentation of the PM performance remains the responsibility of the PM Technician. These areas / services currently include:

1. Welding / Etching machinery
2. Quartz Crystal machining equipment
3. Ceramics Laboratory equipment
4. General Building Utilities Maintenance
5. Oversee chemical waste disposal for PCB NY- Chemical Room, HCD, Machine Shop, Crystals; and Chemical waste disposal for PCB-NC.
6. Production Oven cleaning

Additionally, any scheduled department implemented service, due to Quality Concern or Audit Finding Preventative Action, shall continue to be performed by the assigned Department representative.

**Metrics**

Metrics comparing services completed on time or late, versus the services required, are formulated from Express Maintenance data and/or reports, via the PM Metrics spreadsheet maintained in the R:\Quality\Preventive Maintenance directory. Services will be considered late if, after entry of a scheduled week’s worth of performance, any service remains greater than one day overdue. Metrics tracked are PCB Depew and PCB NC Performance per Department and Total Performance per Site (PCB Depew, PCB NC and PCB Machining). Resulting charts shall be updated weekly by the PM Tech and distributed to departmental supervision responsible for overseeing Preventive Maintenance. Any weekly Site performance level less that the PCB Goal of 95% shall be investigated by the PM Technician, to determine from the responsible Supervisor, any Assigned Causes for the deficiency. Results of any investigation shall be recorded in the PM Metrics Spreadsheet. Additional metrics may be generated as needs arise.

**Referenced Documents:**

QA074, QA116, QA145.