**Measurement System Control and Evaluation**

 1. **Measurement System Evaluation**

 [Your Company Name Here] shall determine the capability of all measurement systems used to evaluate control characteristics. A measurement system is the combination of the measurement tools and the personnel who utilize them. The statistical process control coordinator will maintain this program.

 Measurement systems will be checked to determine accuracy, reproducibility, stability and repeatability. Measurement systems will be checked for all new processes or products before the first production run. If this is not possible, because of the availability of parts or other reasons, the check will be made during the first production run. In addition, whenever there is an indication of possible measurement error in existing products, the measurement system will be checked.

 When the measurement system variation is determined to be excessive, as determined in 12.5 of this section, the SPC coordinator will notify the quality assurance manager and director of quality control. The quality assurance manager is responsible for corrective action.

 Detailed instructions for measurement system evaluation are specified in the [Your Company Name Here] measurement Gage R&R procedure.

 2. **Gage and fixture control**

 The gage and fixture control program is the responsibility of the metrology department.

 The normal calibration frequency, unless otherwise noted, will be once per year. If [Your Company Name Here] is incapable of certifying a gage, it will be sent to an outside source for certification. If at any time a gage is suspected to be out of calibration due to mishandling or any other reason, the gage will be recalibrated. A record of each gage, fixture, micrometer, etc. Will be kept detailing its history of calibrations. Any time a gage is found to be nonconforming, the gage will be removed from use until it is corrected and recertified. If the gage cannot be recertified for any reason, the metrology manager will destroy subject gage and notify the quality assurance manager. The quality assurance manager has the responsibility to obtain new gaging and specify interim measures such as using the cmm if the part must be run prior to this. If a gauge is found to be out of calibration and has been in use, the quality assurance manager will take corrective action as detailed in the corrective action section of this document.

 Micrometers and calipers will be calibrated monthly using a certified set of gage blocks traceable to the National Bureau of Standards. The gage blocks will be recertified at an outside source once per year.

 Upon receipt of revised part prints, any related fixtures will be checked for conformance to the new engineering change level. At the time of certification or revision, a sticker will be placed on the fixture showing the date, engineering change level, date due for the next certification and either "revised", or "certified". A fixture will be recertified each year regardless of how often it was revised.

 3. **Visual Acceptance Standards**

 When visual characteristics such as color are being judged, acceptance standards will be used. These standards will be approved and signed by customer engineering and/or customer quality assurance. A duplicate set of standards will be kept in a protected area. The standards will be checked against the duplicates once per year for recertification.

 All visual standards will be labeled with a visual acceptance standard sticker.

**Gage Calibration and Certification**

 1. **Procedures - Fixtures**

 a. All fixtures, gages, and test equipment will be calibrated and certified before being used in the inspection system at [Your Company Name Here], including those previously certified by other sources. All inspection/test equipment required by customer engineering standards will require customer engineering approval before initial use of the same.

 b. Fixtures will be inspected to the latest level or revision of math data, mylar, part print, or die model. Data level will be recorded on the inspection report.

 c. Tolerancing will be 10% of print, if this is not feasible then tolerancing will be determined at the design review.

 d. Acceptance criteria is 100% within tolerance.

 e. Discrepancies will be handled following the procedures described in the fixture discrepancy section (12.8) of this manual.

 f. Fixture report will be filed under the id number in the fixture file cabinet. The initial report and the last 2 consecutive reports will be kept on file.

 2. **Procedures - Gages**

 a. See micrometer/caliper section.

 b. Data will be recorded in the gage calibration manual.

 c. Results will be studied, signed and dated by metrology.

 3. **Procedure - Test Equipment**

 a. Calibration of test equipment will be handled through the company that the equipment was purchased. Their standards and procedures must be traceable to the National Bureau of Standards and guaranteed to such standards. Test equipment will include items used by metrology.

 Brown and Sharpe CMM

 Starrett CMM

 Tinius Olsen tensile

 Rockwell Hardness tester

 Gage blocks

 Pin gages

 Profilometer

 Comparator

4. All calibration and certification must be traceable to the National Bureau of Standards and so stated on certificates of calibration.

**Calibration Frequency**

Gages, fixtures, and test equipment will be periodically calibrated. Frequency of the calibration will be determined by the manager of metrology.

*Standard Periodic Calibration Chart*

|  |  |
| --- | --- |
| **Item** | **Interval** |
| Check Fixtures | Yearly |
| CMM | Yearly |
| Tinius Olsen tensile | Yearly |
| Rockwell Hardness tester | Yearly |
| Comparator | Yearly |
| Gage Blocks | Yearly |
| Pin gauges | Yearly |
| Calipers | 30 Days |
| Micrometers | 30 days |
| Height gages | 90 Days |
| Glossmeter | 90 Days |
| Color Standards | Yearly |
|  |  |

**Scheduling**

 Scheduling of all gages, check fixtures, and test equipment for periodic calibration will begin the day of first calibration. Item will be entered into the tracking system, Gagealert™, by id number. See following pages on Gagealert™ and history cards.

**Acceptance Criteria**

 Criteria for acceptance will be as follows:

 1. Check fixtures - tolerancing as noted on approved gage drawings.

 2. Test equipment - published accuracy and repeatability.

 3. Gages - published accuracy and repeatability or 20% of smallest graduation, see section on micrometers/calipers.

**Employee Owned Gages**

 It is permissible for employees to use their own measuring equipment in the performance of their duties. The company requires that the gages be controlled and calibrated under the same procedure as company owned equipment. [Your Company Name Here] is not responsible for loss or damage to the equipment.

 Gages will be given an ID number and placed in the calibration schedule for periodic calibration.

**Fixture Calibration and Certification**

 This document will define the procedure for verifying and certifying fixtures.

 A print of fixture and part needs to be studied to determine the intent of the fixture. All features must identified by a detail number or letter. Inspection report will reference measurements to the detail.

 The fixture print will be marked using colored ID stickers for reference to inspection report. This will include any/all hand applies.

 Points on fixture, including swingplates and SPC bushings will be identified by a number.

 Hand applies will be identified by a letter.

 Acceptance criteria is 100%, any discrepancies will be evaluated by the manager of metrology for acceptance or rejected.

 Once a fixture has been certified, a [Your Company Name Here] certification sticker will be placed on the fixture where it can be easily seen. This form must be completed.

 Gage number - ID # assigned to each gage.

 Description - part name

 Inspector/date -individuals name and date job completed

 Print/rev -source of nominal data

 Due date -date of next calibration

**Gage R & R**

 A gage repeatability and reproducibility study will be performed yearly. This will be included in the yearly certification of each fixture.

**Gage R & R Procedures**

Your Company Name Here] shall determine the capability of all measurement systems used to evaluate control characteristics.

Two types of measurement systems analysis will be used. One type will study gages used to measure variable data while the other type will study gages used with attribute data.

The following procedure will be used for testing a gage that measures variable data. (procedure may be modified based on available parts, operator, etc.)

1. Refer to operators a, b and c and number ten parts 1 through 10 so that the numbers are not visible to the operators. (actual gage users will perform the R & R study.)

2. Calibrate the gage.

3. Have operator a measure the ten parts in a random order and enter the results in column 1 on the gage repeatability and reproducibility report.

4. Repeat step 3 with operators b & c.

5. Repeat the cycle with the ten parts measured in another random order, for the number of trials required.

6. Using the gage repeatability and reproducibility report form, enter the observations on one side and calculate gage repeatability and reproducibility using the formulas on the reverse size.

Generally, the criteria for acceptance of gage repeatability and reproducibility are:

a. Under 10% .........................acceptable

b. 10 to 20% .........................may be acceptable based on importance of application

c. 21% and over ......................generally not acceptable

*The following procedures will be used to evaluate attribute gages:*

 1. Refer to operators a and b (actual gage users will perform gage studies).

 2. Select twenty parts and number 1 through 20 so that the numbers are not visible to the operators.

 3. Of the twenty parts selected, approximately 1/3 should be known acceptable parts, 1/3 should be known defective parts and 1/3 should be marginal parts.

 4. Operator (a) should inspect each of the twenty parts by placing them on the check fixture. Each measurement decision will be recorded in the appropriate space on the attribute gage study.

 5. Operator (b) will then inspect each of the twenty parts.

 6. Step 4 and 5 will be repeated (each part inspected 2 times by 2 operators).

The gage is acceptable if all measurement decisions (4 per part) agree.

Should a gage not pass the R & R study for variable or attribute data, the quality engineer, SPC coordinator, and a tooling engineer will determine the corrective action to be taken.

The gage will be retested following the corrective action.

**Gage Maintenance and Control**

 This documentation will set the procedures for the maintenance and control of checking fixtures, gages; both company owned and employee owned, and storage.

 **Gage Identification**

 All check fixtures, gages, and test equipment will be identified by a Your Company Name Here] assigned serial number.

 1. Check fixtures are identified by the day that initial inspection begins (yr, mo, day).

 *Example: January 23, 1999.......990123*

 *If more than one fixture is initiated in a one day period, then a suffix of -1,-2, etc... will be added to the ID number.*

 2. Gages will be identified when purchased new or when a new employee is hired and he/she has their own inspection gages. Gages will be identified by the department where used and numbered in sequence.

 Example:

 *calipers used in bumper room ..... brc-1*

 *micrometers used in press room ..... prm-1*

 *height gage used in tool room ...... trhg-1*

 3. Testing equipment that is unique or one of a kind to the plant will be identified by the model number of the equipment.

 Example: *Brown & Sharpe CMM .....hv3000*

**Engineering Changes**

 When engineering changes do not affect the part dimensionally, the certification sticker revision must be updated, without any inspection.

 Engineering changes that incur dimensional parameters will require a change be made to the fixture and an inspection of the changed detail. This inspection will be added to the last inspection report. Certification sticker will be updated to new revision level.

 At both of the above incidence the due date of the fixture is not to be changed.

 All tracking media for fixture calibration is to be updated to the latest revision level.

**Discrepancies**

 Discrepancies are to be acted upon immediately. Once the corrective action is complete and certified the certification sticker must be updated, and so noted on sticker. All tracking media must also be updated and documented. See section on discrepancy report.

**Metrology Storage Procedures**

i. Procedure

 a. Area is to be kept clean and in order at all times. Parts and fixtures are to be placed in their assigned positions upon delivery to the storage area.

 b. Any/all fixtures removed from the storage area will be signed out by metrology personnel specifying fixture ID, storage location, date signed out, and department where fixture is to be used.

 c. Fixtures will be removed during first shift hours only. Any job requiring a specific fixture must be scheduled to pick-up check fixture prior to metrology's quitting time, check with lab manager for this information.

 d. Condition and appearance of parts/fixtures must be controlled by metrology and inspection.

1. All components of a fixture must be present.

2. Fixtures/parts must be cleaned using a non-abrasive cleaner and a soft cloth.

3. Any discrepancies must be reported and discrepancy report filled out for corrective action.

4. Inventory sheet must be checked to verify that all components are intact. Hand applies, last piece, inspection instructions all must be included when fixture is signed out of and returned to metrology. This will be checked by metrology personnel every time a fixture is moved in or out.

* No tow-motors will be permitted in the storage area unless requested by the manager of metrology.
* Appliances-parts awaiting sample approval will be placed outside the east wall of the metrology department. Metrology must be notified of parts placed in this area.

ii. Scope:

 This document will set forth the operating procedures for the storage area in the metrology department.

**Product Validation**

 Products that are produced at [Your Company Name Here]or are the responsibility of [Your Company Name Here] are to be certified or validated yearly. It will be the responsibility of metrology to verify all specifications required by the customer; dimensional, mechanical, chemical, and engineering specifications.

 The product validation manual will list all tests required for each part. The tracking of the validation will be handled through the metrology department. Documentation of the testing will be filed in the part file. Scheduling of the testing will correspond with the fixture certification.