

# **QUALITY ASSURANCE MANUAL**

## **PER MIL - I - 45208A**

***THIS MANUAL CONTAINS PROCEDURES, CONTROL FORMS, INTERNAL AUDIT  
CHECKLISTS AND SUPPORT STANDARDS***

**CMS**

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DATE: 02 / 23 / 03

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## SECTION 01

### COMPANY'S PRODUCT AND OVERALL QUALITY POLICY

#### 1.0 **Company's Overall Quality Policy**

- 1.1 Our Company's overall Quality Policy was drafted by top management on a consensus basis and issued by the President of the Company. It contains the following goals and objectives:
- 1.2 The Company's overall quality policy is to help in providing quality products and services in a coordinated quality system approach.
- 1.3 Our main objectives are to achieve a zero defect record, to keep promised delivery dates, to offer our products at a competitive and fair price and stay profitable and increase business. We further try to achieve customer satisfaction and strive for continuous improvements. This is accomplished by implementing and complying with an inspection system based on the Inspection System Standard MIL-I-45208 A and related documentation and standards. Our qualified, trained and highly motivated employees are helping to achieve these goals and objectives.
- 1.4 The company quality policy shall be displayed on our bulletin board, and reviewed by our Quality Assurance Manager with all affected employees.

#### 2.0 **History of Company**

- 2.1 **Creative Machining Systems, Inc.** has been in business since 1971 and provides the following outlined products and services:

#### 3.0 **Description of Product and Services**

- 3.1 The company provides the following products and services:  
General and CNC machining to capabilities of holding tolerances within + - .001", full CAD / CAM capabilities, prototype development and production, rush work, precision sheet metal fabrication, welding services and fabrication, all types of coatings and plating, silk screening, and reverse engineering.

## SECTION 02

### POLICY, ORGANIZATION AND PLANNING (Contractor Responsibilities)

1. The purpose of this Quality Assurance Manual is to outline and document an Inspection System based on the MIL-1-45208A Inspection System Standard.
2. Outlined policies and procedures address Inspection System requirements pertaining to inspection and testing which are necessary to assure product conformance to drawings, specifications, purchase order and customer contract requirements.
3. Quality assurance management in coordination with assigned engineering and planning personnel are given the responsibility by the President to plan, review, implement and maintain inspection system policies and procedures, complying with customers' purchase order or contract requirements to assure a quality product.

4. The General Manager in coordination with the Quality Assurance Manager is responsible for designating and assigning authority to qualified management personnel and affected shop personnel to carry out functions that assure implementation, maintenance and control for outlined Quality Assurance Policies and procedures. Assignments shall be documented in the "Functional Organization Chart", Form Q.A.02.
5. Engineering and Planning in coordination with the assigned Quality Assurance Manager and other affected personnel within the organization shall have the responsibility to obtain, review, document and control implementation of in-house established workmanship standards, procedures and work instructions pertaining to quality, inspection and testing. They are further responsible to plan, implement and document where necessary the appropriate inspection and test procedures as outlined in this quality assurance manual. This will assure quality and specified requirement compliance through documentation from the time when purchase order or contract is awarded and reviewed to the final phase when product is manufactured, completed and shipped.
6. This quality assurance manual, along with outlined policies and procedures, will be reviewed at least annually for current status and compliance to outlined policies and procedures. Audit checklists may be used for review purpose, see Assurance System Audit, Form Q.A.14. Results of this review will be recorded on Form Q.A.01 Change and Review Record when applicable, and Form Q.A.14 Quality Assurance Audit. If effectiveness of the inspection system is not achieved then improvements have to be initiated via revised procedures.
- 6.1 When required by purchase order or contract, the same review will be applied to active outside subcontractors and suppliers. Any major changes to the inspection system shall be subject to approval by customer and/or the government representative, or regulatory agencies, as applicable
7. Our documented inspection system shall be made available to our customer and to the Government Representative when required.
8. Described policies and procedures in this quality assurance manual will be maintained current and available to affected in-house personnel, government and regulatory agencies and/or our prime contractor representatives.
9. Our Quality Assurance Manager in coordination with assigned management personnel is responsible for implementation and maintaining this documented quality and inspection system.

**SECTION 03**  
**QUALITY AND INSPECTION SYSTEM AUDIT**  
**(Inspection System Review and Evaluation)**

1. The Manager of Quality Assurance will audit Quality Assurance policies and procedures, enforcement and inspection effectiveness to assure compliance with contract or purchase order requirements, on a regular scheduled basis. But at the very least semi annually.
2. Our in house Quality Assurance System will be audited by our Quality Assurance Manager and assigned trained personnel semi annually or as required per purchase order or contract. Initial Quality Assurance audits will also take place at subcontractors or vendors prior to issuance of a purchase order, if required by purchase order or contract, or when other quality concerns are part of the purchase from such an outside

source. Results will be recorded on Form Q.A.01 and/or Form Q.A.14, as applicable. Inspection System checklists will be used when in house audits are performed and results recorded.

3. Form Q.A.15, "Pre-Award Quality Vendor Survey", will be sent out to applicable outside suppliers to be filled out completely and returned to us. This will give us an initial indication of our suppliers' inspection system status and its qualifications as a supplier.
4. The Quality Assurance System shall be audited more often if results indicate lack of compliance in a particular section or department.
5. Details of this audit and actions taken will be documented for trace ability and are available for customer and/or government representative's review. See Forms Q.A.01, Q.A.14, and Form Q.A.15 and the individual audit checklists for records.
6. Any upcoming changes, revisions, deletions or additions affecting policies and procedures of this Quality Assurance Manual shall be recorded on Form Q.C.01, and affected revised pages shall be dated and numbered accordingly.

**SECTION 04**  
**QUALITY PLANNING, CONTROL OF DRAWINGS & DOCUMENTATION CHANGE CONTROL**  
**(Drawings and Changes, Documentation and Records)**

1. The documented inspection system shall provide for quality planning and procedures, which will assure that the most current applicable drawings, specifications, engineering orders and change orders, and amendments required by contract and/or purchase orders, are used and/or implemented. The above applies to design when applicable, fabrication and assemblies, inspection and testing, and packaging, labeling and shipping
2. All drawings, change orders and related specifications shall be controlled, implemented and maintained by Engineering and Planning in coordination with the Quality Assurance Department, monitored by the Quality Assurance Manager.
3. It shall be the Planning Department's responsibility to assure that all drawings, change orders, shop travelers and related specifications are distributed in a timely manner to affected personnel and affected workstations. A copy of the shop traveler shall (as applicable and as internal communication is organized) be submitted to the Quality Assurance Manger for review and control.
4. **PROCEDURES:**
  - Step 1.** Upon receipt, review and acceptance of a customers contract or purchase order, all applicable blueprints, drawings, documents and related specifications shall be forwarded to Engineering and Planning and Quality Assurance, as applicable.
  - Step 2.** Quality Assurance in coordination with Engineering and Planning will now check, evaluate and review for correct part number, spec. number and most current required revision letter and date, and all other applicable data, including legibility of documents and drawings.

- Step 3.** Planning will now record the above findings on "Drawing and Specification Assurance Record", Form Q.A.03 (Ref. Form Q.A.03, Form Q.A.04, Form Q.A.05 and Form Q.A.09, as applicable.) If additional copies of blueprints, drawings and specs are required, they shall be ordered at this time.
- Step 3a.** Before any drawing and/or specification is released to either in house manufacturing or to outside subcontractors, a Drawing/Purchase Order Review and Release Stamp, Form Q.A.05, will be applied to respective document by designated personnel. (See Organization Chart, Form Q.A.02), indicating compliance to review and purchase order/ contract requirements and prepare for official release. No drawing shall be released without showing a drawing review and release stamp on the drawing.
- Step 4.** Whenever change orders to a blueprint, drawing or specification are received, Production Control shall recall all outstanding blueprints, drawings and specifications, which are affected by the change order and incorporate latest change order into affected blueprints, drawings, specifications or issue new and up-to-date blueprints, drawings and specifications. (Refer to Form Q.A.03, Form Q.A.04, and Form Q.A.05, as applicable.)
- Step 4a.** An "ECO Change Record" stamp shall be applied to respective blueprints and/or specifications and applicable ECO number shall be filled in respective column. Now the re-issuance of re-called blueprints, drawings and specifications can safely take place. (Refer to Form Q.A.04.)
- Step 5.** As blueprints, drawings and specifications are issued by Engineering and/or Planning, such issuance shall be recorded on Drawing Document & Assurance Record, Form Q.A.03, if applicable.
- Step 6.** Obsolete drawings, specs, etc. shall be marked obsolete and kept in a separate file cabinet for reference purposes only, or shall be destroyed. (Refer to Form Q.A.03.)
- 5.** This procedure also applies to all subcontractors and vendors, which have been issued copies of drawing or specs by our company.
- 5.1** Our Purchase Manager will carry out these control procedures, unless other in house personnel is assigned to perform such function.
- 6.** If the company, while checking and evaluating blueprints, drawings, specifications, and inspection and testing documents, should find either an error and/or an improved method or a more economical way of complying with all contract or purchase order requirements while still being able to maintain or improve function and quality of product, then the company will forward these findings in Form of an Engineering Change Proposal or an informal letter to respective customer for further evaluation.
- 7.** Complete contract compliance concerning rights in data shall be maintained.
- 8.** After contract and/or purchase order has been completed, the blueprints/drawings and/or specs shall be filed in the respective job folder and kept for four (4) years, or at the very least for the length of the contract or purchase order, unless otherwise required by contract.

**SECTION 05**  
**INSPECTION AND MANUFACTURING OPERATION PLANNING**  
**(Inspection and Testing, Process Control)**

1. It shall be the responsibility of assigned Planning Personnel (Ref. "Organization Chart", Form Q.A.02) to assign a job or work order number upon receipt and acceptance of purchase order and/or government contract, and record such assigned job number or work order number on Form Q.A.21. Now you initiate a Work order and/or a Manufacturing Operation Document in Form of a Shop Traveler, using Form Q.A.09.
2. The Shop Traveler Form Q.A.09, shall in sequence show all manufacturing and inspection operations necessary to comply with blueprint, drawing, purchase order and customer and contract requirements. Accept and reject findings, including quantity accepted and/or rejected, as well as the person assigned and authorized to perform such functions shall be indicated on this Form.
3. Upon completion of the planning of manufacturing and inspection operations, and prior to release to Manufacturing, the Manufacturing Operations Document (Shop Traveler) Form Q.A.09 shall be forwarded to the Quality Assurance Manager for review and approval. This approval shall be indicated by signing the Manufacturing Operations Document (Shop Traveler) in the space provided.
4. No Manufacturing Operations document (Shop Traveler Form Q.A.09 or similar) shall be released to Manufacturing without the approval of Quality Assurance Management.
5. Selected machinery shall be subject to preventive maintenance control and shall be recorded on Preventive Maintenance Log Form Q.A.31. A preventive maintenance label Form Q.A.32, shall be affixed to selected machinery, see Form Q.A.32 Preventive Maintenance Label.

**SECTION 06**  
**CONTROL OF PROCUREMENT - PURCHASE ORDER REVIEW**  
**(Purchasing Control and Documents)**

1. All suppliers of materials, processes and/or services and/or products or raw material shall demonstrate a capability of delivering above products, services or materials with the highest degree of quality and as required by purchase order or contract. These capabilities shall be evaluated through a review of suppliers' capabilities and/or on site facilities by submitting and reviewing a Quality Vendor Survey Form Q.A.15. Findings of the supplier's facility - Quality Assurance System will be evaluated and, if approved, recorded on Form Q.A.14.
2. A list of approved suppliers, Form Q.A.14, shall be on file and maintained for traceability by Quality Assurance and Purchasing. Suppliers shall be added or deleted from these forms as the evaluation status changes. No purchases shall be made from sources, which are not approved, or some form of vendor review is on file.
3. All outgoing Purchase Orders (Ref. Form Q.A.24) for material, products and/or other services, shall be reviewed by designated Quality Assurance personnel to assure the inclusion of appropriate Quality Assurance provisions and requirements governing the companies outside vendors and suppliers. Where applicable, Certified Test Reports and/or Certificates of Conformance shall be part of the company's requirements. Designated Quality Assurance person shall sign off outgoing purchase order with regard to

Quality Assurance requirements when required by customer contract, otherwise review and signature by assigned purchasing personnel is sufficient.

4. If it is impossible or impractical to determine quality conformance upon receipt of material or product, then the items shall be either source inspected or objective evidence of product quality and/or configuration compliance shall be required. This shall also be indicated on the purchase order document Form Q.A.24. Accompanying Inspection and Test Reports may be one Form of objective evidence showing compliance.
5. All incoming material and products are subject to receiving-inspection. Findings are logged on Receiving Inspection Log, Form Q.A.12.
6. Receiving -Inspection Records (Form Q.A.12 and Form Q.A.17, if applicable) are maintained and filed for traceability and evaluation. (Ref. also Section 10, Receiving Inspection.)

## **SECTION 07**

### **CONTROL OF STORAGE, IDENTIFICATION & HANDLING OF RAW MATERIALS (Receiving Inspection and Furnished Material)**

1. A list of company and customer approved sources are maintained at Receiving-Inspection (Ref. Form Q.A.14) for traceability. All suppliers of raw materials, hardware and services procured for use on government or when required on specific customer contracts, shall be required by purchase order to submit chemical and physical test reports or certificates of conformance, as applicable and if required by purchase order or contract. Manufacturer's identification of raw materials by process batch, heat number, lot, type or class shall be maintained on the materials. (Ref. Form Q.A.09, Form Q.A.12, and Form Q.A.16, as applicable.)
2. A copy of purchase orders and all certifications will be filed in respective job folders and are maintained for permanent record and traceability, after review and acceptance in receiving inspection.
3. Quality Assurance shall have periodic tests made to verify the validity of the test reports received. The determination of verification intervals will be based on the quality history for each material from a given source. Manufacturer's identification of raw materials by process batch, heat number, lot, type, class, etc. shall be maintained on the materials itself and/or on correlated records, as required.
4. All incoming material, supplies and processed items will be inspected upon receipt, against copy of purchase order, to assure conformance. All accompanying raw material or inspection and test certificates and documents will be reviewed and checked for purchase order compliance and filed after acceptance in respective assigned job folders for traceability. Incoming inspection findings will be recorded on Receiving Inspection Log Form Q.A.12 (and Form O.A.17, if required) and filed in respective job folder for traceability.
5. No material or product shall be released for production and manufacturing until verified and accepted by Receiving Inspection. (Ref. Receiving Log Book, Form Q.A.12, Form Q.A.16, and Form Q.A.17, as applicable.)
6. All incoming inspected accepted material or product is identified with an "Acceptance Tag", Form Q.A.16a, and accompanying Inspection-Report, Form Q.A.17, if applicable. Accepted material will then be put into assigned and identified storage room until used for manufacturing. Traceability, when required, for accepted material shall be accomplished by entering all pertinent data into the Receiving Log Book,

Form Q.A.12. Accompanied material certificates, or processing certificates and the like shall be reviewed and signed off with I-stamp after acceptance and filed in respective job file folders to assure traceability.

7. All incoming inspected unacceptable or rejected material shall be identified with a "Reject Tag", Form Q.A.16c, and accompanied by Inspection Report Form Q.A.17, if applicable. Unacceptable material shall be placed in a segregated area (identified material withhold or bond room) until returned to the supplier, or other arrangements have been made.
8. Special processing sources controlled by customers:  
An "Approved Process Source List", supplied by customer shall be filed and controlled by purchasing and will be used and complied with for purchasing special processes and services.
9. Assigned and identified stock room and material storage areas are restricted and will be used only by authorized personnel. A periodic annual inspection by Quality Assurance for good housekeeping shall be maintained. Record of inspecting stock room will be filed. Good housekeeping is maintained as part of the company policy. Records shall be maintained in Form Q.A.14 for review and evaluation purpose.
10. Assigned personnel are instructed and trained to handle and protect incoming material properly and with care to avoid any damage, contamination and/or deterioration.
11. Age controlled and shelf life items are inspected for date of manufacture and expiration date, and findings are recorded on product Shelf Life Log Form Q.A.20. (See also Section 22 - Shelf Life Control.)
12. Raw material, sheet and bar stock are adequately identified (Use Form Q.A.16a for identification) and stored. Accompanying material certifications are filed and maintained for traceability.
13. Castings and Forgings are handled in the same manner as outlined in above Paragraphs.
14. All accepted accompanying material certs are stamped off on top right corner with Acceptance-Inspection Stamp and acceptance date. Applicable Job Number and/or purchase order number relating to accepted material are also noted on these certs this will assure "Right Cert to Right Job."
15. First-in, first-out stock rotation is practiced, when feasible. (Ref. Form Q.A.29, "Stock Room Parts Control Card".)
16. Remnant materials are identified and stored in stock room. (Use Form Q.A.16a.)
17. When material is issued from the stock room to Production, it is so noted on the Manufacturing Operations (Shop Traveler) Form Q.A.09. In addition, the following information may also be recorded: material certifications, job number, and purchase order number, test and inspection reports, as applicable. (See Form Q.A.09.)
18. Annual review for maintaining good house keeping and procedures compliance of stocked raw material shall be performed and recorded on Form Q.A.14.
19. One sample of raw material selected at random shall be submitted annually to an approved independent material testing laboratory to verify compliance and accuracy of material certs with regard to correct mechanical properties and chemical composition. Applicable MIL Spec's are on file at Receiving-

Inspection for cross-reference purposes. This will be performed only when explicitly required by DOD or Prime Contract or customer. Otherwise, verification of material and process certification traceable to National Institute of Standards (NIST) shall be sufficient.

## **SECTION 08 PROCEDURES AND WORK INSTRUCTIONS (Inspection and Testing Documentation)**

1. It shall be the responsibility of assigned Engineering, Planning and Quality Assurance personnel to write up procedures and work instructions adequate to assure compliance with all areas of the contract or purchase order. This will be maintained, upgraded and distributed to affected personnel as necessary to cover the functional elements of engineering, procurement, fabrication, processing, assembly, inspection, disposition of nonconforming articles, inspection and test and shipping. (Ref. Form Q.A.09, Form Q.A.17, Form Q.A.19, and any other applicable control Form used in this manual).
2. Work instructions are initiated and issued to provide specific direction to inspection personnel in the areas of receiving, first article, in process and final inspection, as well as calibration, manufacturing and tests, handling, storage, preservation, packaging and shipping. (Ref. Form Q.A.04, Form Q.A.07, Form Q.A.09, Form Q.A.17, and Form Q.A.19, as applicable).
3. Quality Assurance shall maintain adequate records of all inspection and tests functions performed for traceability. (Ref. Form Q.A.09 and Form Q.A.17.) Criteria for approval and rejection of product shall be included in respective control forms. (Ref. Form Q.A.09, Form Q.A.17, and Form Q.A.19, as applicable.)
4. Quality Assurance will review and approve acceptance and test procedures adequate to comply with purchase order/and/or contract requirements. (Ref. Form Q.A.08 and Form Q.A.17, as applicable.)
5. Inspection operations and/or required witnessed test procedures are performed, recorded and reviewed before products are presented to customer for acceptance by qualified Quality Assurance personnel, and recorded for traceability. (Ref. Form Q.A.09, and Form Q.A.17.)
6. Actual measurement values and results are obtained during inspection and/or testing, and recorded on Form Q.A.17 for traceability, when required or deemed necessary to assure quality and traceability.

## **SECTION 09 STOCK ROOM CONTROL (Furnished Material and Storage)**

1. Designated and identified stock room and material storage areas are restricted and only used by authorized personnel.
2. A periodic inspection by Quality Assurance shall be maintained. Records of inspection shall be filed and maintained for traceability on Form Q.A.14.
3. First-in, first-out stock rotation is practiced, where applicable.
4. Remnant material will be properly marked with the appropriate label and test reports will be put in the box along with parts to assure the best possible traceability or filed in assigned job file folder.

5. All material, after receive inspected and accepted, will be released to stock room and/or material storage area. Boxes or bins where material is stored will be identified with an Acceptance Tag 16a. Part number, applicable revision letter, part name, serial number, lot number, acceptance revision number or letter, description of part and lot number shall be recorded as required. The same information will be recorded on a stockroom file record card, Form Q.A.29 as required.
6. Stockroom items will be issued and released against requisition, work order or other Form of control instructions or document. Issue of stockroom items shall be recorded on Form Q.A.09, and/or on Form Q.A.21 as applicable.
7. Good housekeeping and a clean and orderly stock room area is maintained, monitored by our Quality Assurance Manager and all affected personnel.

**SECTION 10**  
**IN PROCESS INSPECTION**  
**(Inspection and Testing, Process Control)**

1. In process inspection is pre-planned to be compatible with manufacturing operations and written instructions are implemented into our Manufacturing Operations Document (Shop Traveler) Form Q.A.09. (Use Form Q.A.09 and Form Q.A.17, if applicable.)
2. At periodic intervals during the production run, inspection shall verify that the articles produced continue to meet drawing configurations and specified requirements.
3. All applicable inspection findings will be recorded on Inspection Report, Form Q.A.17, and filed in job folder for traceability, when required or deemed necessary to assure quality and/or traceability.
4. Should certain characteristics be found to be out of tolerance, then all parts produced since the last inspection shall be screened for those characteristics. All parts found to be discrepant shall be segregated from the remainder of the lot and identified with a "Reject Tag", Form Q.A.16c. For disposition, use Form Q.A.17 and Form Q.A.19. Written procedures for rework and/or repair and disposition will be used. (Ref. Form Q.A.09, Form Q.A.17, and Form Q.A.19, as applicable.)
5. Tolerance Interpretation: Specified tolerances are considered to be "Absolute". Meaning that Measurements shall not be rounded off, to meet requirements.
6. All in process-inspected items are identified as such (Ref. Form Q.A.09, Form Q.A.16a and Form Q.A.17, as applicable) and are protected and handled properly to preclude damage or loss throughout the manufacturing operations.
7. Surplus material will be properly identified, inspected and returned to stock. (See section 8-Stockroom Control)
8. Good housekeeping, clean and well-lit and orderly manufacturing and inspection areas shall be maintained and periodically inspected for compliance.
9. Inspection stations are provided and located in adequate areas to provide maximum control.

10. On production jobs or where data gathering is recommended due to SPC contract requirements, Form Q.A. 17 and other process control documentation will be used, including SPC charts and similar, as applicable. (See also section 14-Sampling Inspection).

**SECTION 11**  
**INSPECTION AND TESTING PROCEDURES**  
**(RECEIVING, FIRST ARTICLE, IN-PROCESS AND FINAL INSPECTION)**

1. Planned Inspection and Test operations and procedures are reviewed and approved by Planning and Quality Assurance Management before issued to manufacturing (Shop Floor in Form of the Shop Traveler Form Q.A.09) or other work instructions. Inspection is performed by trained inspection personnel and by delegated machine operators. After carrying out planned manufacturing and inspection and test operations, the finished and/or final product, material or operation can be presented to customer for acceptance.
- 1a. The Company maintains a policy for an annual vision test for inspection personnel, as well as an initial vision test on hiring date, as well as a color blindness evaluation, if applicable and where necessary due to purchase order or contract requirements.

**RECEIVING INSPECTION**

1. All shipments received will be inspected and/or tested for conformance and compliance to blueprint, drawing and specification requirements, against copy of purchase order (Ref. Form Q.A.01, Form Q.A.09 and Q.A. 14.) Actual measurement results are obtained and recorded on Form Q.A.12 and/or Form Q.A.17 for traceability, when required by purchase order or contract or when deemed necessary to assure quality and traceability.
2. Records of all products inspected and tested, shall be maintained and filed in designated job folder for traceability.
3. All items in the receiving area are physically and carefully separated into three categories:
- a) Items awaiting receiving inspection or testing
  - b) Items which have been inspected and comply to blueprint, drawings and specifications.
  - c) Items rejected and withheld, waiting for disposition.
4. Upon completion of receipt inspection, the items shall be identified with an Acceptance Tag Form 16a, if all requirements have been met, or a Rejection Tag Form 16c, if non-conformances have been found. (Ref. Form Q.A.16a and Form Q.A.16c.)
5. If items are accepted the Manufacturing Operations Document Shop Traveler-Form Q.A.09, the Receiving and Inspection Log Form Q.A.12, the Inspection Report Form Q.A.17, and/or if applicable, test reports or certifications, shall all be signed off with acceptance inspection stamp and filed in job folder for traceability.
6. Nonconforming products shall be identified with a Rejection Tag, Form Q.A.16c, and placed in a confined, segregated withhold area or bond room accessible only to authorized personnel. After disposition by

Quality Assurance, nonconforming articles shall be returned to the supplier with a Supplier Corrective Action Report Request, Form Q.A.06.

7. All material and products shall be properly handled and stored to prevent damage, contamination and deterioration.

### **FIRST PIECE INSPECTION**

1. Upon completion of a manufacturing or machine set-up, the first item produced shall be submitted to Quality Control for First Article Inspection and recorded in the Manufacturing Operation Document Shop Traveler Form Q.A.09, for traceability, when required and/or when deemed necessary to assure quality.
2. Quality Control shall inspect this first item to verify all blueprint/drawing configurations for the called out manufacturing operation and shall, if item complies, initiate acceptance by stamping off the operation in the Shop Traveler Document, Form Q.A.09 and Form Q.A.17, in the First Article column, with an acceptance inspection stamp.
3. Should the first item manufactured and inspected by First Article Inspection not meet blueprint/drawing configurations, the inspector shall tag rejected item with a Rejection Tag, Form Q.A.16c. The inspector shall notify the operator and/or whoever is in charge of manufacturing and first article set-up, with the request to submit, after respective change of set- up, a new item for First Article Inspection. Rejected part will be segregated and placed in a bond room for evaluation and disposition.
4. Configurations (Dimensions) for either accepted or rejected First Article items are recorded on Form Q.A.17 for permanent record and traceability and filed in respective job folder, if applicable and/or so required.
5. Instructions to Production Control and lead personnel are as follows: No items shall go into production unless First Article Inspection finds item accepted by inspection and complies with respective manufacturing operation instructions and blueprint/drawing call out. The go-ahead and OK for a production run shall be initiated by applying Acceptance Inspection Stamp on Manufacturing Operations Document Shop Traveler Form Q.A.09 and Form Q.A.17, as applicable.

### **IN PROCESS INSPECTION**

(SEE SECTION 9-In Process Inspection)

### **FINAL INSPECTION**

1. Upon completion of all manufacturing and processing operations conforming to Manufacturing Operations document Shop Traveler Form Q.C.09, all items shall be forwarded to Quality Assurance for final inspection.
2. All inspection and production personnel are trained and instructed to perform inspection and testing properly and per written procedures and instructions. Manufacturing personnel will be instructed to handle final manufactured items properly and with care so as not to damage final product. Good housekeeping practices and orderly and clean environment in the Final Acceptance and Test Area are maintained, monitored by our Quality Assurance Manager.

3. The items shall be final inspected against all blueprint/drawing configurations and a final configuration and/or test report shall be filled out, when required by contract, otherwise previous accepted performed inspection and test activities shall be confirmed, and the Shop traveler Form Q.A.09 stamped off under final inspection. Final inspection shall also verify final product quantity and that all operations have been carried out and that all documentation is complete.
- 3.1 All critical product dimensions shall undergo final inspections or tests, performed by trained inspection personnel, verified by our Quality Assurance Manager. (Ref. Form Q.A.09, and Form Q.A.17.) These forms shall be filed in respective job folders for traceability, after results have been recorded.
4. If items comply with blueprint/drawings and specifications and purchase order requirements, then final inspection operation on Shop Traveler Form Q.A.09 and Form Q.A.17 shall be stamped off with an Inspection Acceptance Stamp.
5. If purchase order or contract requires it, then individual parts shall be identified with an Inspection Acceptance Stamp. If size of item does not make it feasible for stamping on parts, then items shall be identified with an Acceptance Tag, Form Q.A.16a, or similar identification tag.
6. All items, which are, found to be discrepant and do not comply with blueprint/drawing requirements, shall be identified with a Rejection Tag, Form Q.A.16c. All rejected items shall be segregated from the balance of the lot inspected and shall be placed in a bond room or segregated in a with hold area for evaluation and Quality Assurance disposition. (Ref. Form Q.A.09, Form Q.A.17, and/or Form Q.A.19.) If rejected parts can be used as is, and/or customer disposition allows the rejected parts to be either modified or items are reworkable and/or are replaced, then this will be initiated and recorded on Form Q.A.09 and Form Q.A.19, for traceability.
7. If items are accepted and comply with blueprint/drawing requirements as well as with all process specification requirements, then at this time the inspector shall pull job folder and check and verify that all required Certifications, Certificates of Conformance, First Article Inspection Report In-Process and Final Inspection Report and all other related and required documentation are completed and are on file and comply with Purchase Order requirements. Company maintains records of interchangeability when applicable. (Ref. Form Q.A.09, Form Q.A.17, and Form Q.A.26, as applicable.)

### **PACKAGING AND SHIPPING INSPECTION**

1. After above outlined procedures have been performed by assigned personnel, the go ahead and OK for identification, packaging and shipping will be initiated by applying inspection stamp on the Shop Traveler Form Q.A.09, under the final inspection operation.
2. Upon completion of identifying items when so required, and the packaging, boxing or wrapping of all items by assigned personnel, then Quality Assurance shall be notified for verifying these activities and that items are ready for shipment.
3. Upon approval of the packaging methods and approving all accompanying shipping paperwork, including all required Test Reports, Certifications, Certificates of Conformance, and all other related and required documents, the inspector shall stamp off all the above documents (Ref. Form Q.A.09, Form Q.A.17, and Form Q.A.26, as applicable) with his acceptance inspection stamp to indicate acceptance. Now shipment of products can take place.

4. Checklist for shipment verification Form Q.A.26 shall be used only where the complexity of parts or assemblies justifies it, or where it is explicitly required by Department Of Defense contract, Prime Contractor or by other customers.

## SECTION 12

### INSPECTION STATUS AND INSPECTION STAMPS

**(Indication of Inspection Status)**

1. Quality Assurance will make certain that all products shall retain an indication of product inspection status at all times. This is accomplished through the use of either the Shop Traveler Form Q.A.09, and/or "Accept" and "Reject" Tags, Form Q.A.16a and Form Q.A.16c respectively, and the inspection stamping on the Shop Traveler Form Q.A.09. Either a Shop Traveler and/or identification tag shall accompany each container, lot or batch. (Ref. Form Q.A.09 and/or Form Q.A.16.)
  - 1a. All items, either in a lot or as a single entity (prototype), are identified, tagged or labeled and shall be accompanied to each work or test station by a Shop Traveler, Form Q.A.09. At the same time, a respective Inspection Report or Test Report Form Q.A.17 also accompanies item, if applicable and/or required. This will assure positive identification of respective inspection status at each stage of the process. The same procedures will be maintained by split orders, whereby copies are made of above Quality Assurance Forms and inspection stamps are utilized, and then same above-described procedures apply.
  2. At no time shall inspection tags or other identification be removed from any product while in process, except by authorized Quality Assurance personnel.
  3. Numbered inspection stamps with company symbol shall be assigned to all Quality Assurance and delegated inspection personnel. These inspection stamps shall be safeguarded at all times and their loss reported immediately. (See also Form Q.A.18 Inspection-Stamp-Log).
  4. Inspection Stamp Log and Control:
    - a) Should a stamp be lost or an employee who has been assigned stamps be terminated, the complete set of stamps shall be withdrawn from use and not reissued for a period of six months.
    - b) A record of issuance shall be maintained for each set of stamps. This record shall indicate to whom issued and the dates of issuance and return, (Ref. Form Q.A.18.)
    - c) The configurations of stamps used are shown below:
 

<b>O</b>	=	Acceptance Stamp - Denotes acceptance of an operation or final acceptance as noted on associated paperwork.
<b>Δ</b>	=	Triangle Stamp - Denotes acceptance of a useable non-conformance. Used only when authorized by customer.
<b>D</b>	=	Defective Stamp - For use on parts and applicable paperwork where parts have been determined to be unacceptable and are to be submitted to MRB for disposition.

**SECTION 13**  
**PRESERVATION, PACKAGING AND SHIPPING**  
**(Product Control and Delivery)**

1. The preservation, packaging and shipping of completed products shall be monitored by Quality Assurance as per purchase order and customer requirements and written or referenced procedures on the Shop Traveler, Form Q.A.09.
2. When specified by contract or purchase order, the customer's requirements shall be defined on the Shop Traveler, Form Q.A.09, and verified by Quality Assurance.
3. In the absence of specific requirements in the contract, the packing and marking of articles shall comply with common commercial practices, rules and regulations, and will be designed to ensure safe arrival and ready identification at destination.
4. Quality Assurance has the responsibility for inspecting and verifying conformance of outgoing shipments for applicable preservation, packaging and marking requirements.
5. Evidence of such inspection will be recorded on the Shop Traveler Form Q.A.09, and/or shipping documentation.
6. Adequate storage facilities are maintained and used for safe storage of the product between final acceptance and shipping.
7. If special packaging is required by an outside packaging house, all articles for shipment will be accompanied by an in house purchase order (see Form Q.A.24) which will specify exact purchase order number and/or government contract number, packaging requirements. A copy of purchase order Form Q.A.24 will be filed in respective job folder for traceability.
8. Checklist, Form Q.A.26, to verify shipping requirements and documentation to be enclosed in the shipment, is used if applicable.
9. Product configurations and completion of processes are verified prior to shipment. (See Section 10, Inspection and Testing).
10. Checklist for verification, Form Q.A.26 shall be used only where the complexity of parts or assemblies justifies it, unless required by DOD or Prime Contract, or by other customers.
11. Certificate of Conformance, Form Q.A.22, with regard to configuration control and material and process certification are provided when requested. (See above outlined procedure in paragraph 9 for reference.)

**SECTION 14**  
**CALIBRATION AND CONTROL OF MEASURING AND TEST EQUIPMENT**  
**(Measuring and Test Equipment)**

1. Quality Assurance shall ensure conformance of products to purchase order and contract requirements by performing scheduled calibration of all inspection, calibration and testing equipment. Calibration shall be based on MIL-STD-45662 A, when and where applicable.

2. It shall be the responsibility of Quality Assurance to implement and maintain a calibration system for measurement and test equipment to support and fulfill all contractual requirements with the following documented procedures: (Designated calibration intervals and control thereof shall be implemented, Reference Form Q.A.07, Q.A.08, and Form Q.A.25.)
3. All company owned and in house inspection, measuring and test equipment shall be individually serialized with a serial number and recorded on a "Tool/Instrument Record Card", Form Q.A.07, with the following additional information: name of tool or instrument, frequency of calibration, procedure for calibration (see Section 13A), the date calibrated, inspected and date due for next calibration, name of inspector performing calibration, and the certification document number showing deviations from standard values. All customer furnished tools, instruments, gages and test equipment are subject to the same control as company owned tools, when applicable.
4. The calibration interval and source of calibration shall be noted on the "Tool/Instrument Record Card", Form Q.A.07. The calibration interval may be shortened or lengthened only when documented evidence exists that this may be done without violating the continuing accuracy of the tool or instrument. (See "Calibration Evaluation Form", Form Q.A.08.)
5. After calibration of each tool or instrument, a Calibration Cert. Label, Form Q.A.28, shall be affixed to either the tool/instrument itself or its container, which will indicate the date of current calibration, the date when calibration is due and identify the person, subcontractor or source that performed the current calibration,
6. Out of calibration and or damaged measuring, inspection and test (IMT) equipment, as well as inactive standards, are segregated, identified and put into a bond room to prevent accidental use. (Ref. Form Q.A.16c. and Form Q.A.30.)
7. Measurement reference standards such as gage blocks used for calibrating measuring and test equipment in house are calibrated at regular intervals by approved outside commercial metrology labs. Quality Assurance will make sure that calibration performed by those approved facilities is certified and documented as being traceable to the National Institute of Standards (NIST). Certifications and related documents are kept on record and are available for inspection and verification.
- 7a. Calibration intervals are established based upon stability, purpose and usage. Our adjustment of intervals is based upon these findings.
- 7b. Serial numbers of any measurement-reference standards (gage blocks, etc ... ) used for calibrating measurement transfer standards shall be recorded on respective Tool/Instrument-Calibration Record Card Form Q.A.07, when used for actual calibration, to assure traceability.
- 7c. Assigned calibration intervals on measurement reference standards traceable to National Institute of Standards (NIST) shall be every 12 months.
- 7d. Assigned calibration intervals on measurement transfer standards such as micrometers, shall be every 90 days. Those intervals shall be subject to change and tightened or extended, depending on results, once a traceable calibration history has been established. (See also Section 13.a.)
8. Following measurement (reference) standards are calibrated by approved metrology lab contractors:

- a. Surface Plate, Inspection Grade A.  
Serial Number:  
Inspected By:  
Inspected at yearly intervals. See Form Q.A.07 Tool Record Card and Certifications.
  - b. Gage Block Set, Inspection Grade A  
Serial Number:  
Inspected By:  
Inspected at yearly intervals, See Form Q.A.07 Tool Record Card and Certifications.
  - c. Above reference standards are calibrated in a temperature controlled environment and are certified as being traceable to the National Institute of Standards
9. Measurement (transfer) standards used to measure, gage, test, and inspect products for compliance to blueprints, drawings and specifications and contractual requirements are calibrated in house against standard written calibration procedures, when feasible. (Ref. Section 13A.)
10. Following measurement transfer standards and test equipment are calibrated against above-mentioned standard procedures:
- a. Outside Micrometers: 0-6", Interval 90 Days.  
Serial Number:  
Accuracy requirements, see standard calibration procedures in Section
  - b. Dial Caliper: 0-6" and 0-12", Interval 90 Days.  
Serial Number:  
Accuracy requirements, see Section 13A
  - c. Height Gage: 12", Interval 90 Days  
Serial Number:  
Accuracy requirements, see Section 13A.
  - d. Dial Indicator: .0005 and .0001, Interval 90 Days.  
Serial Number of .0005:  
Serial Number of .0001:  
Accuracy requirements, see Section 13A.
  - e. Optical Comparator:  
Interval Annually  
Serial Number:  
Calibrated by approved metrology lab-contractors.
  - f. Harness Tester:  
Interval Annually  
Serial Number:
11. Environmental control in our Inspection Room is maintained and controllable through a Hygrometer. Temperature is kept constant at 68 degree to 70 degree Fahrenheit; humidity at 40% to 45%. When applicable, a soak-in period of 24 hours will be applied to allow adjustment from a non-controlled

environment to a temperature-controlled environment. This will assure a reasonable continuation of measurement accuracy.

- 12.** Out of tolerance measuring and test equipment will be handled in the following manner:
  - a)** Measuring equipment will be identified and tagged with a Rejection Tag, Form Q.A.16c. Equipment will then be removed from inspection facilities and stored in the bond room. If feasible, equipment will be repaired, recalibrated and returned to Inspection for further use. If not repairable, equipment will be scrapped.
  - b)** If excessive wear or defects in equipment prevent proper calibration, equipment will be removed and scrapped.
  - c)** If out of tolerance measuring and test equipment are inadvertently used for inspection on actual manufactured products, those products will be 100% re-inspected with calibrated and acceptable measuring and test equipment.
  - d)** An out of tolerance condition shall be considered significant when it will result in acceptance of a non-conforming product. For compliance, see Calibration Evaluation Form, Form Q.A.08.
  - e)** If parts and/or products have already been shipped to customer and are inadvertently inspected and/or tested by out of tolerance measuring and/or test equipment, such customer will be notified immediately and a 100% re-inspection of described product will be initiated. See also Paragraph 12c of Section 13. (Ref. Form Q.A.17, column "Instrument checked with ")
- 13.** Control of subcontractor and customer calibration IMT equipment is the company's Quality Assurance responsibility by actually inspecting their calibration facilities and making sure that their calibrations are traceable to the National Institute of Standards (NIST) and that they conform to MIL-STD-45662A when applicable and all contractual requirements. (Ref. Form Q.A.07, Tool Record Card, and Form Q.A.14.)
- 14.** Quality Assurance will assure that proper handling, clean environment and storage of all measuring and test equipment is complied with.
- 15.** Control of employee owned tools and gages are subject to the same controls as company owned tools, when used for final inspection and final acceptance. Otherwise they are considered for reference only.
- 16.** If applicable, necessary calibration adjustments are sealed after certification.
- 17.** Adequate facilities used for transportation, storage, calibration of all tools, gages and test equipment are provided by the company.
- 18.** All government property tooling shall be identified and properly stored, recorded and maintained. (Ref. Form Q.C.07 and Form Q.A.09.)
- 19.** Quality Assurance will post "in House Calibration Schedule", Form Q.A.25, in a conspicuous place in the Inspection Department to serve as a reminder of upcoming in house calibration due dates, unless PC media controls are utilized.
- 20.** An adequate in house tool/instrument checkout and accountability system is in effect. (Use Form Q.A.27.)

21. New or reworked tools will be "proven" prior to usage. (Use Form Q.A.07.)
22. Calibration intervals are established based upon stability, purpose and usage. Our adjustment and assignments of intervals is based upon these findings.
23. Serial numbers of any measurement-reference standards (gage blocks, etc.) used for calibrating measurement transfer standards, shall be recorded on respective Tool/Instrument Calibration Record Card when used for actual calibration, to assure traceability.
24. Assigned calibration intervals on measurement reference standards traceable to the National Institute of Standards (NIST) shall be every 12 months.
25. Assigned calibration intervals on measurement transfer standards shall be every 90 days. Those intervals shall be subject to change once a traceable calibration history has been established, utilizing records on Form Q.A.07 and Q.A.08.
26. All inspection equipment, and personnel are made available upon request

## **SECTION 15 PROCEDURES AND INSTRUCTIONS FOR IN HOUSE CALIBRATION OF IMT EQUIPMENT**

### **OUTSIDE MICROMETERS**

Gages and Equipment Used	1" Gage Block .500" Precision Steel Ball Wrench for Adjusting Shell
Accuracy Requirements Indicated Measurement Micrometers	.0001 for .001 Reading Micrometers .00005 for .0001 Reading
Parallelism and Flatness of Measuring Faces	.00005" (This is not new tool tolerance, but we feel that it is impractical to inspect closer than this without using Optical Flats.)
Alignment of Measuring Faces	.001"

### **PROCEDURES:**

1. Parallelism and Flatness of Measuring Faces - Using the .500" steel ball, measurements shall be taken over the ball at the center of the measuring faces and four points near the outside edge of the measuring faces, 90 degrees from each other. These five readings shall not vary from one another more than .00005" (To simplify this value, it amounts to approximately half the width of the reading line on the shell of the micrometer.)
2. There shall be no perceptible side shake in the fit between the spindle and its bearing at the hub of the micrometer

3. Alignment of Anvil and Spindle - With the measuring faces closed, the anvil and spindle shall be within alignment within .001"
4. Set Adjustment Shell to Zero Line - The measuring faces shall be cleaned by lightly closing them on a piece of clean paper and withdrawing the paper from between them. They shall then be closed to a position consistent to either the inspector's feel or ratchet or friction thimble provided. At this point, the reading line on the adjusting shell shall be aligned with the zero line on the thimble using the spanner wrench for the adjustment. There shall be sufficient drag on the movement of the adjusting shell so that it may not be unintentionally moved while in use. The average new tool requirements show a minimum of 3-1/2 inch lbs. torque.
5. Inspect for Lead Accuracy - The micrometer shall be opened to maximum range and the 1" gage block set between the measuring faces. Measurement of this block shall result in readings within .00005 on .0001 reading micrometers and .0001 on .001 reading micrometers of the actual block size.
6. Thread Fit - In returning the screw to zero, the smoothness of motion should be noted. There shall be no perceptible endplay or side shake in the fit between the screw and the nut.
7. Operation of Ratchet or Friction Thimble - Both of these should be run to assure the force to operate is consistent throughout the full turn. They should carry the spindle at all points throughout the range.

### **INSIDE MICROMETERS**

#### Gages and Equipment Used

Indicator Bench Stand  
Length Standards for Setting  
Indicator  
Wrenches for Adjusting Rod Points

#### Accuracy Requirements

Indicated Measurement of  
Micrometer Head +/- .0002".  
Accuracy of Rod Setting +/- .0002".

### **PROCEDURES:**

1. Inspect to assure that there has been no damage done to the rods or the head. The rods shall be straight and the seating surface free from burrs or nicks. The rod-seating surface on the head shall also be free from burrs and nicks.
2. Accuracy of Indicated Measurement - Using the indicator stand with the applicable setting standards, the micrometer head shall be inspected at minimum and maximum range and shall be accurate to within 0002".
3. Thread Fit - Micrometer head should be run through the full range to assure smoothness of movement. There shall be no end or side play in the fit of the screw.
4. The contact end of the micrometer head and the contact points of the rods shall be spherical. Any wear will not have produced flats on these contacts.

5. Rod Accuracy - Using indicator gage and applicable setting standards, each rod shall be assembled to the micrometer head. Rod length accuracy shall be within .0002". Rods outside this tolerance shall be adjusted at this time.

### MICROMETER DEPTH GAGES

Gages and Equipment Used	Height Standards - Increment of 1" With Range of 1" through 8" Surface Plate or Flat Steel Block of Equal Accuracy. Wrenches for Adjusting Rod Nuts.
Accuracy Requirements	Indicated Measurement of Micrometer Head +/- .0001". Accuracy of Rod Length +/- .0002".

### PROCEDURES:

1. Inspect for damage of measuring face of rods and seating surface on rods, also rod reading surface on micrometer head.
2. Indicated Measurement of Micrometer - With the 0-1" rod in the micrometer, set the micrometer reading to zero and the rod adjustment to zero with the micrometer base on the surface plate. Using the 1" height setting block, the micrometer should read 1" within .0001.
3. Each depth rod shall be inserted into the micrometer and the top cap tightened in place. There shall be no endplay of the rod in the micrometer.
4. Each rod inserted in the micrometer shall be inspected on the applicable height setting gage for correct length adjustment. This shall be within +.0001.
5. Thread Fit - With a rod in place in the micrometer, the screw shall be operated throughout the full range to assure that there is no end or side play and that movement is smooth.
6. Operation of Ratchet - The ratchet should be run to assure the force to operate is consistent throughout the full turn. It should carry the micrometer screw over the full range of the tool.

### VERNIER CALIPERS

Gages and Equipment Used	1" Outside Micrometer 1" Gage Block Straight Edge
Accuracy Requirements	Jaw Parallelism .0003" in Toe-in Direction Straightness of Bar .0005" Per Foot Readout Accuracy .0005" Per Foot

**PROCEDURES:**

1. Parallelism of Jaws - The jaws shall be closed on a 1 " gage block and locked in position. By sliding the block between the jaws at this point, any out of parallel condition can be detected. This error shall not amount to more than .0003 in the toe-in position
2. With the jaws closed on the 1" gage block, the outside reading vernier plate shall read 1".
3. The nibs shall be closed to zero reading on the outside plate. A measurement shall be taken over the outside of the nibs with the 1" micrometer and the reading noted. The inside reading plate shall be set to this reading.
4. Straightness of Bar - The slide locating edge of the bar shall be compared to a straight edge for accuracy of straightness. If the bar has not been bent, original tool accuracy will be maintained. Additional gage blocks may conduct the further check for accuracy of the bar, although we feel that this is not necessary if the bar has not been subjected to bending.

**VERNIER HEIGHT GAGES**

## Gages and Equipment Used

Surface Plate of Known Accuracy  
 Master Reference Bar or Gage Block  
 Stack  
 Height Transfer Gage  
 .0001 Reading Last Word Indicator

## Accuracy Requirements

Parallelism of Scriber Arm to Base  
 .0003"  
 Flatness of Base .0002"  
 Readout Accuracy .0005" Per Foot

**PROCEDURES:**

1. Parallelism of Slide Bar - At any point in the range of the tool, the slide shall be locked in place and the zero reference surface of the slide arm indicated on the surface plate to assure parallelism with the base.
2. Flatness of Base - At the same setting as in No. 1 above, the indicator shall be located on the reference surface of the slide arm and pressure exerted at the forward and back edges of the base to assure that no rock in the base is evident. This shall not register on the indicator more than .0002".
3. The reference surface of the slide arm shall be set at 1" from the surface plate using the reference bar and measurement transfer tool. The vernier plate at this point should read 1".
4. Selected heights throughout the range of the tool may be inspected in the same manner as in Step No. 3 of the above to assure that .0005" per foot accuracy is maintained, or the slide locating edge of the bar may be inspected to a straight edge and if no damage to the straightness of the bar is evident, it may be assumed that the initial accuracy of the tool has been maintained.

## DIAL INDICATORS

Gages and Equipment Used	Inspection Fixture Utilizing Micrometer Head, such as No. 716.
Accuracy Requirements	Accurate to +/- 1 Graduation in 2-1/2 Revolutions Repeatability +/- 1/5 Graduation

### PROCEDURES:

1. Operation - Indicator shall be operated by hand throughout the full range in such a manner to assure that movement is smooth, free and unobstructed.
2. Rack Fit - The fit between the rack and lower bushing should not be worn to allow lateral movement in the rack to the point where this movement will register on the dial more than 1/4 the width of the hand.
3. Bezel Operation - The bezel shall rotate smoothly and shall be locked in a positive manner by the bezel lock.
4. Contact Point - The contact shall not be worn to the extent that a flat area is evident on the radius of the point.
5. Accuracy - Using the inspection fixture, the indicator shall be tested throughout the range to assure accuracy of 0 graduation is maintained. By repeating micrometer settings at random points, readings shall not vary more than 1/5 graduation.

## DIAL CALIPERS

The requirement for the dial caliper is +/- .001' anywhere within the range of the tool, using any of the measuring features. The following is the manner that we recommend inspecting the accuracy.

### PROCEDURES:

1. Jaws for Outside Measurement - Set by closing jaws together and rotating bezel indicator to read zero. Measurements shall then be taken over gage blocks, 1' through 6", in steps of 1", to establish movement is accurate to within +/- 1 graduation.
2. Parallelism of Outside Measuring Jaws - Using a precision plug of approximately .250 diameter, measurements should be taken over the plug at both the top and the bottom of the bearing surfaces of the outside jaws. The difference between the measurements taken at top and bottom of the jaws should not vary more than .0002 (1/5 of 1 graduation).
3. Accuracy of Inside Reading Jaws - Measurement should be taken using the inside jaws on a .250" ring gage and a 1.000" ring gage. The dial reading should not vary from the ring gage sizes more than +/- 1 graduation.

4. Depth Rod and Step Measurement Jaw - Both are inspected by slightly opening the sliding jaw and then closing the tool by placing the depth rod on a flat surface and pushing the rod until it is flush with the end of the bar. The dial reading should be zero within +/- 1 graduation.

### **SOLID SQUARES**

The accuracy of the squares that we use as masters is normally determined by comparing masters using the three square method. This consists of comparing three squares against each other; i.e., working two of these tools to shut out light against each other, and then inspecting both of these against the third square. When all three squares can be compared to each other and have no error evident in the comparison, all three have to form a perfect 90-degree angle. By using this method to establish accuracy, we claim traceability to the National Institute of Standards. The National Institute of Standards accepts accuracy by determination derived from a geometrically proven procedure.

### **PIN AND WIRE GAGES**

#### **PROCEDURES:**

1. Diameter and Cylindricity - Diameter of check pins with tolerance range +/- .001 and higher will be checked for wear and tear. Accurate diameter and cylindricity will be checked with indicator micrometer, accuracy range +/- .0001. Three diameter readings shall be taken on three equally spaced locations on the pin. Deviations shall not exceed +/- .0002.
2. Straightness of Pins - Straightness of pins will be checked by placing pins flat onto the surface plate. Place test indicator randomly on top surface of pin on three equally spaced locations. Indication results shall not exceed +/- .001 over the length of the pin. Average deviation shall not exceed +/- .001.

## **SECTION 16 SAMPLING INSPECTION**

### **(Sampling Inspection by Attributes and Variables)**

1. Sampling inspection shall be performed in Receiving-In-Process and Final Inspection, unless otherwise stated in the contract or purchase order. All sampling shall be in accordance with MIL-STD-105 (Z1.4) (Sampling by Attributes) and/or MIL-STD-414 (Sampling by Variables), single sampling, normal Inspection Level 11, AQL 1.5 (Acceptable Quality Level), subject to approval by government or customer representative. Type of sampling shall be by "Attributes Sampling and Variables Sampling". (An example of above is go-no go gages when sampling by attributes and by actual measurement of product when sampling by variables.) Type of sampling shall be as follows:

**Sampling by Attributes:** Whereby go-no go principle is applied and the count of defectives are recorded.

**Sampling by Variables:** Whereby actual measurements are performed and results recorded.

2. Findings of sampling inspection are defined and recorded on Form Q.A.17, for traceability.
3. Functional characteristics, such as leak and pressure testing, hardness testing, and so on, will be performed in accordance with purchase order and contract requirements, and results are recorded on Form Q.A.17, for traceability.

4. Reduced or tightened sampling inspection will be used if results, purchase order, or contract requirements warrant it.
5. Inspection records show lot-size, sample size and acceptance number (see Form Q.A.17) when sampling inspection is performed. Normal or detailed inspection will be indicated on Form Q.A.17.
6. Inspection personnel are instructed and trained on how to use MIL-STD-105 (Z 1.4) MIL-STD-414, and SPC in general-and specifically on sampling inspection pertaining to purchase order and contract requirements. Written procedures/sampling plan charts and SPC control charts are worked out and supplied by Quality Assurance management to inspection personnel performing required sampling inspection, applicable to purchase order or contract requirements.
7. The sampling plan described in Paragraph 1 above is subject to approval by either government and/or customer contract purchase order requirements.
8. Critical, Major and Minor dimensions shall be complied with per customer defined requirements. If customer does not specify Critical, Major and Minor dimensions, then Paragraph 1 of Section 14 shall be used as a guideline. Critical characteristics shall always be inspected 100%; major and minor characteristics shall be inspected per sampling plan.
9. In-House Sampling Plan per MIL-Std 105 (Z 1.4):

<b>Dimensional:</b>	<b>Tolerances:</b>	<b>I-Level</b>	<b>AQL%</b>
<b>Critical</b>			
<b>Major:</b>			
<b>Non-Critical:</b>			
<b>Visual:</b>			
<b>Testing:</b>			
<b>Receiving:</b>			

**SECTION 17**  
**NONCONFORMING MATERIAL AND CORRECTIVE ACTION**  
**(Control of Nonconforming Material)**

1. A documented system of control of nonconforming material and corrective action is maintained, and is on file for traceability. This system is designed for detection of discrepant material, segregation of discrepant material, and identification and/or marking of discrepant material. It also determines the cause of a nonconformance, initiates corrective action and serves to prevent future recurrence.

**IN HOUSE DISCREPANCIES**

2. Discrepant articles are identified, segregated and placed in a bond room or material with hold room awaiting disposition. Quality Assurance shall immediately present the "Shop Traveler" Form Q.A.09 and the "Material Withholding Report" Form Q.A.19, to the department responsible for the discrepancy. (Ref. Form Q.A.06, Form Q.A.09, Form Q.A.17, and Form Q.A.19, as applicable.) The "Material Withholding Report" contains the following information: part number and/or serial number, part name, description of discrepancy, action taken to correct the discrepancy, action taken to prevent reoccurrence, disposition, signature of initiator and authorizing person.

3. Affected management personnel shall immediately investigate the cause of the problem and propose corrective measures to prevent reoccurrence of the discrepancy. These corrective action measures shall be recorded on Form Q.A.19.
4. When this investigation is completed, the "Shop Traveler" and discrepant articles shall be returned to Quality Assurance for review and follow-up of the Corrective Action Statement. (Ref. Form Q.A.09 and Form Q.A. 19.)

### **SUPPLIER DISCREPANCIES**

5. When corrective action is required by a supplier, Quality Assurance shall request that Form Q.A.06 be forwarded to the respective supplier or vendor.
6. A reply (corrective action) shall be required to this form within ten (10) working days. If a reply is not received within this time, no further shipments from the supplier will be accepted until an adequate corrective action commitment is received.

### **BUYER REQUEST FOR CORRECTIVE ACTION**

7. If the discrepant condition is determined to be an in house responsibility and affects the customer's purchase order requirements, customer will be notified for disposition and the buyer's request will be processed per Paragraphs 2 and 3 above. A copy of Form Q.A.17 and Form Q.A.19 shall be forwarded to buyer.
8. If the discrepancy is attributed to a supplier or a subcontractor, expedient action will be taken to obtain an answer for the buyer as per Paragraphs 5 through 8.

### **DOCUMENTATION**

9. All information relative to the "cause" and "correction" of defects must be documented along with specific actions such as persons contacted, tool numbers, dates, serial numbers, etc. Trends or repetitious conditions require special details or explanations. (Ref. Form Q.A.06, Form Q.A.09, Form Q.A.17, and Form Q.A.19.)
10. All records and documents shall be filed in job folder for traceability.
11. All nonconforming material or products shall be identified with a Rejection Tag, Form Q.A.16c, segregated and stored in bond room area until reviewed and disposition is made by Engineering in coordination with Quality Assurance.
12. All discrepant material shall be identified with Rejection Tags, Form Q.A.16c.
13. After detection of a discrepancy or nonconforming material and a corrective action has been initiated, repair or rework can only take place if customer's disposition allows it.
14. Rework of nonconforming articles shall be in accordance with documented procedures acceptable to the government or customer. (Ref. Form Q.A.16c, Form Q.A.17, and Form Q.A.19.) Articles that are capable of being reworked to drawing configurations will be returned to Manufacturing for rework and completion of operations. This action will be documented on the "Shop Traveler" as an additional operation (rework),

Form Q.A.09, and returned to Inspection for verification of the "complete to drawing" operation when completed.

15. Upon receipt of authorization from the customer to vary from contract requirements (use as is or authorized rework), the articles shall be handled and identified in accordance with the customer's instructions.
16. All articles designated as scrap shall be mutilated to prevent inadvertent return to normal productive channels. Scrap parts shall be contained in a identified Scrap Container, and discarded as soon as possible.
17. Purchased items falling into this category will be handled as described in Paragraphs 11 and 12 above (when practical), before they are returned to the supplier.
18. Quality Assurance is represented in the Material Review Activity and will chair or co chair the Material Review Board.
19. Preliminary MRB action is initiated at the discretion of Quality Assurance Manager depending on scope and criticality of the rejection.
20. Rework will be handled on a individual bases, with instructions annotated on the traveler.

## **SECTION 18**

### **TOOLING USED FOR INSPECTION, POLICIES AND PROCEDURES**

#### **(Inspection Provisions and Alternatives)**

1. This procedure is applicable to all jigs, fixtures, tooling masters, templates, patterns and other devices used as a media of inspection and to those personnel responsible for use and care of those items.
2. All production tooling (used as a media of inspection), whether purchased or manufactured, will be inspected against the design drawing prior to release for use. Inspection records will be prepared (Form Q.A.07 and Form Q.A.17) and intervals established for future inspections. Special instructions (if required) will be prepared and all documents relating to each item of tooling filed in Quality Assurance or project file. All tooling will be assigned a tool number for identification and control purposes.
3. Accuracy of manufacturing tooling may be established by inspection of the articles produced (tool proofing). Such equipment is stored in an environment to prevent damage or loss of accuracy.
4. Subject tooling will be inspected at specified intervals by a qualified inspector using the design drawing and/or special instructions provided. Those items not meeting the specified requirements will be tagged and returned to Quality Assurance for filing in the appropriate "Production Tooling" files and updating of the Tool Inspection Record, Form Q.A.07 and Form Q.A.16.

## **SECTION 19**

### **RECORDS OF INSPECTION AND TESTS**

#### **(Records and Retention)**

1. All documents pertaining to articles being manufactured shall be filed and maintained in designated job folders in the Planning or Quality Assurance Office or any other designated area for easy access.

2. The records shall indicate the nature and number of observations made, the number and type of deficiencies found, the quantities approved and rejected, and the nature of corrective action taken as appropriate. (Ref. Form Q.A.06, Form Q.A.09, Form Q.A.17 and Form Q.A.19, as applicable.)
3. When the final shipment against a purchase order has been made, the Quality Assurance "Job Folder" shall be closed and forwarded to the closed files. Records shall be held for a period of four (4) years, or the length of the contract, unless otherwise required by purchase order or contract.
4. Records maintained to substantiate our Quality Assurance system shall include, but not be limited to, the following:
  - a. Certifications and test reports for all materials and processing.
  - b. Completed "Manufacturing Operations Sheet or Shop Traveler".
  - c. Copies of all shippers and purchase orders.
  - d. Copies of all inspection and test reports
  - e. Copies of "Certificate of Conformance",
  - f. All Inspection and Test related Documents.
  - g. Tooling inspection records,
  - h. Inspection and test equipment calibration records.
  - i. Inspection stamp distribution records.
  - j. Personnel certification, if applicable.
  - k. Records of any other related documents pertaining to Quality Assurance and purchase order and/or contract requirements.
5. All records are available for review by customer.
6. All records are used as a basis for management, action and evaluation of Quality Assurance effectiveness.
7. All records shall assure that all inspection operations and tests are performed per purchase order and/or contract requirements and provide accept/reject criteria, as well as number of articles accepted and number of articles rejected.

**SECTION 20**  
**PRODUCT IDENTIFICATION, HANDLING AND GOOD HOUSEKEEPING**  
**(Inspection Status and Maintaining Product Integrity)**

1. Designated and assigned personnel (Engineering, Planning, Quality Assurance Manager) shall maintain written procedures and instructions to control identification of articles throughout all phases of

manufacture, inspection and storage. (Ref. Form Q.A.10 and Form Q.A.19.). Use identification tag Form Q.A.16a for all products being processed and accepted in house and/or Shop traveler Form Q.A.09.

2. Maintain good house keeping and proper handling of products, and good workmanship practices to prevent damage, loss, substitution and quality degradation.
3. Scheduled audits for complying to quality system requirements, for maintaining stockroom control, for maintaining product identification and for maintaining a clean work and inspection environment is conducted by the Manager of Quality Assurance to assure compliance. (Ref. Form Q.A.14. and Audit Checklists).
4. Employees are trained in handling products properly so not to damage parts unnecessary. Company Workmanship Standards shall instruct personnel in proper handling of product and good housekeeping procedures.

## **SECTION 21 GOVERNMENT AND/OR CUSTOMER SOURCE INSPECTION**

1. It is understood that the Government or Customer reserves the right to inspect products at the source, or at a subcontractor's facility. Engineering, Planning, and Quality Assurance (Top management) will comply with these requirements as outlined, and will monitor the planning activities as outlined in following paragraphs:
  - a) When Government/Customer inspection in house is required, Quality Assurance will plan and build in a "Government/Customer Inspector Requirement into our "Shop Traveler", Form Q.A.09.
  - b) When Government/Customer inspection is required at subcontractor's, Quality Assurance will add to the purchase order the following statement: "Government/Customer inspection is required prior to shipment from your plant. Promptly notify government representative." (Form Q.A.13) This shall not constitute government acceptance, nor shall it replace contractors in house inspection.
2. Our company is aware that Government inspection shall not constitute final acceptance nor shall it replace our responsibility to inspect and test product to specified requirements and it will not relieve us to furnish an acceptable end product.

## **SECTION 22 GOVERNMENT AND/OR CUSTOMER FURNISHED PROPERTY**

1. When material is furnished by the government or by customer, it shall be the responsibility of Receiving Inspection to:
  - a) Inspect the articles to determine any transit damage or deterioration and compliance to contract or purchase order.
  - b) Inspect for completeness and proper type, configuration and grade. (Ref. Form Q.A.12, Form Q.A.16a, and Form Q.A.17, as applicable.) Identify product after inspection and place in assigned area.
  - c) If necessary and applicable, perform functional testing to determine satisfactory operation.

2. Adequate identification, protection, inspection and control shall be provided to preclude damage or deterioration during handling and storage. (Ref. Form Q.A.12, Form Q.A.16a, and Form Q.A.17, as applicable.)
3. Should any government or customer furnished property or material be found damaged, malfunctioning, or otherwise unsuitable for use, it shall be immediately segregated and identified. (Use Form Q.A.16c.) Quality Assurance shall determine and record probable cause and deficiencies which make it necessary to withhold material from use. (Ref. Form Q.A.09, Form Q.A.13, Form Q.A.14, and Form Q.A.17, as applicable.)
4. Rework and/or repair of nonconforming supplies shall be in accordance with documented procedures acceptable to the government.
5. Adequate storage and maintenance of government and/or customer property shall be provided and maintained.
6. When government/customer furnished property is supplied to a subcontractor, records will be maintained as to inspection, configuration control, and location of such property. Periodic site inspections will be conducted to assure that such property is examined for damage, abrasive usage, missing parts, functional testing, adequate storage to prevent damage, and unauthorized alterations or use. (Ref. Form Q.A.07.)

### **SECTION 23 PROCESS CONTROL**

1. Process control procedures shall be an integral part of the inspection system when such inspections are a part of the specifications of the contract.
2. Outside processing which is performed on articles to be delivered on government or customer contract and which are not readily detectable or measurable by inspection or test of the finished article, shall be performed only by certified sources and under controlled conditions. (Ref. Form Q.A.14, Form Q.A.17, and Form Q.A. 23, as applicable.) Accompanying process certificates shall be mandatory.
3. When outside companies or process houses are utilized for these processing or special processes services, they shall be approved per procedures outlined in Section 5-Control of Procurement, of this manual.
4. All articles received which have been processed by outside sources, shall be accompanied by a "Certificate of Compliance", with all accompanying process specifications and related documents. (Ref. Form Q.A.22.)
5. On a special process, where the use of customer-approved sources are a requirement, the company shall obtain a copy of the customer's "List of Approved Special Process Sources". This list shall be made available to the personnel responsible for issuing purchase orders to initiate outside special processing. The Manufacturing Operations Sheet (Shop Traveler Form Q.A.09,) shall indicate usage of approved outside special process source. A copy of the customer's "List of Approved Special Process Sources" shall be made available to -Inspection personnel, and recording activities in the Receiving Log (Form Q.A.12) shall be used for traceability.

## **SECTION 24 SHELF LIFE CONTROL**

1. All articles such as rubber goods, paints, seals and adhesives which have a limited shelf or storage life, shall be controlled to preclude the delivery of over-age components to a customer, or the use of over-age components on or in items to be delivered to a customer. (Ref. Form Q.A.12, Form Q.A.20, and Form Q.A.29, as applicable.)
2. At the time of receiving inspection, all limited shelf life articles shall be identified with the date at which their useful life expires, and all other pertinent dates. (Ref. Form Q.A.20 and Form Q.A.29, as applicable.)
3. Stock room or storage areas shall be periodically audited (as required) by Quality Assurance to assure that over-age materials have been withdrawn and disposed of or uses up before expiration date. Records of the audit will be maintained in the stockroom or storage area. (Ref. Form Q.A.20 and Form Q.A.29.)
4. Items, which can deteriorate or corrode will be properly cleaned and/or preserved and packaged and identified accordingly,
5. Proper stock rotation will be observed.
6. The system will correlate calendar age with environmental exposure when special environments are part of the assigned limited shelf life stipulation. For example: Add Storage--opened versus unopened,- Exposure to Light--activated versus inactivated; etc. Traceability shall be accomplished through Shelf Live Log, Form Q.A.20, and/or by using Stockroom Control Card Form Q.A.29.
7. Quality Assurance Manager is assigned to control all above outlined activities in coordination with affected management personnel.

## **SECTION 25 TRAINING AND CERTIFICATION OF PERSONNEL**

1. When job assignments, required by contract or customer purchase order, require a demonstrated level of knowledge or skill in either manufacturing or inspection functions, then personnel which carry's out these functions shall be trained in the required skills and be certified as competent.
2. The certification program shall include the requirements of customer specification and/or other requirements or procedures as applicable, including periodic re-certification.
3. A Training and Certification Log shall be initiated at the time above requirements are carried out, indicating name of personnel trained, date of training and/or re-certification. (Ref. Form Q.A.10.) When necessary then a training plan such as Form Q.A.11 will be utilized for planning and recording training topics and schedules.