Quality Control Manual  
Nanmac Corporation

Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction and Scope</td>
</tr>
<tr>
<td>II</td>
<td>Management Responsibility</td>
</tr>
<tr>
<td>III</td>
<td>Quality System Policy</td>
</tr>
<tr>
<td>IV</td>
<td>Customer Requirements and Order Change Control</td>
</tr>
<tr>
<td>V</td>
<td>Production Controls</td>
</tr>
<tr>
<td></td>
<td>• Receipt of Materials and Services</td>
</tr>
<tr>
<td></td>
<td>• Materials Handling and Storage</td>
</tr>
<tr>
<td></td>
<td>• In Process Controls</td>
</tr>
<tr>
<td></td>
<td>• Finished Product Inspection</td>
</tr>
<tr>
<td></td>
<td>• Shipping</td>
</tr>
<tr>
<td>VI</td>
<td>Quality Procedures</td>
</tr>
<tr>
<td></td>
<td>• Tool, Gage, and Electrical Test Equipment Calibration</td>
</tr>
<tr>
<td></td>
<td>• Defective Material Control</td>
</tr>
<tr>
<td></td>
<td>• Stamp and/or Signature Control</td>
</tr>
<tr>
<td></td>
<td>• Special Process Controls</td>
</tr>
<tr>
<td></td>
<td>• Vendor Rating</td>
</tr>
<tr>
<td></td>
<td>• Record Retention and Trace-ability</td>
</tr>
<tr>
<td></td>
<td>• Standard Quality Control Forms</td>
</tr>
</tbody>
</table>

Section I  
Introduction and Scope

Nanmac Corporation since its beginning in 1956 has strived to establish and maintain a stringent QC and Inspection Program to assure that all of its products meet or exceed stated specifications. We are a dynamic leader in the specialized field of temperature measurement and control in both industrial and research applications. Such here-to-fore “impossible” applications such as temperatures of re-entry heat shields, gun barrel bore surfaces, shock waves and automobile brake pad surfaces has led to industrial applications such as true part temperatures in the injection mold cavity of plastics, zinc, and glass; furnace temperature measurements to 4,200 degrees Fahrenheit, etc. These new developments have lead to many new patents which have greatly advanced the state-of-the-art on temperature measurements. These new instruments have been awarded top National Awards by two separate and independent agencies; Materials in Design Engineering and the instrument society of America.

The above accomplishments have been made with the assistance of a comprehensive Quality Assurance Program. This program is intended to meet the requirements of Mil-Std-Q-9858A and other applicable procedures. Nanmac Corporation has a continuing objective to improve on its QC procedures and develop and establish new criteria as new instruments are being developed.
Section II
Management Responsibility

General Policy

Executive management is ultimately responsible for establishing, implementing, and maintaining the quality system. Specific responsibilities include: formulating the quality policy, defining the organization structure, authorities, and responsibilities and periodically reviewing the quality system.

Procedural Policies

1 Management Representative

1.1 The President of Nanmac is the Management Representative (MR) who has the authority and responsibility to ensure that the Quality Management System is maintained and its efficiency is continuously improved and that the system always complies with the requirements of Mil Std-Q-9858A.

2 Organization

2.1 The Nanmac Corporation quality organization is comprised of five Departments.
   • Sales Department
   • Engineering Department
   • Production Department
   • Quality Assurance Department
   • Administration Department

2.3 The President and General Manager constitute the Executive Management Team.

3 Responsibilities

3.1 Executive Management Team
   • Formulates the Quality Policy
   • Initiates and supervises the Quality System
   • Provides resources necessary to maintain the system
   • Conducts management reviews of the Quality System
   • Oversees goals established to reduce rejects in all phases of the Company’s operations and products

3.2 Sales
   • Provides pricing quotations
   • Prepares product specifications from catalog or customer specified requirements
   • Carries out contact and order reviews
   • Provides customer liaison and service
   • Coordinates customer complaints and product servicing with Quality Control and/or Management

3.3 Engineering
   • Design products
• Initiates design reviews
• Verifies and tests the designs
• Documents design requirements (prints and specific process and inspection instructions, if applicable) for Production and Quality Assurance
• Validates the design or product specifications against the customer specified requirements
• Collects field performance and reliability data
• Specifies product packaging for shipping purposes
• Identifies and documents safety and proper handling instructions of Nanmac products

3.4 Production

3.4.1 Production Planning
• Determines Production Personnel and Equipment Requirements
• Performs Production Engineering
• Prepares Production Plans and Schedules
• Coordinates Withdrawal of Inventory from Stores
• Establishes Safety Procedures for all Departments

2.4.2 Production
• Manufactures Products
• Controls and Monitors Processes
• Defines Workmanship Standards
• Maintains Production Equipment

3.5 Inspection and Test

3.5.1 Quality Assurance
• Performs incoming, in-process and final material inspections and testing in accordance with statistically correct sampling procedures
• Maintains and Calibrates Measuring and Test Equipment
• Carries Out Supplier Quality Surveys and Audits
• Monitors and Assesses Suppliers Performance
• Handles Non-Conforming Products
• Identifies Inspection and Test Status of Materials
• Maintains Inspection Records
• Identifies and Controls Customer Supplied Materials

3.6 Administration

3.6.1 Responsibilities
• Establishes and Maintains the Quality Management System
• Confirms Implementation of the Quality System
• Provides ongoing reviews of the Quality System

3.6.2 Document Control
• Establishes and Maintains Procedures to Control all Documents Related to the Quality System
• Assures that Changes to Quality System Documents are Reviewed
• Approved and Maintained in Accordance with Company Policy and
  Contractual Requirements

3.6.3 Personnel
• Documents Personnel Qualification Requirements
• Maintains Training Records and Schedules

3.6.4 Procurement
• Selects Qualified Supplies and Subcontractors
• Prepares and Approves Purchasing Documents
• Purchases Materials
• Reviews and Establishes Optimum Purchasing Levels for Parts and
  Materials
• Identifies and Handles Materials in Accordance with Quality Plans
• Provides Secure Storage Areas to Prevent Damage or Deterioration of
  Materials Pending Use
• Assures Protection of Product Quality After Final Inspection and Test
• Protection Extends to Destination when Contractually Required
• Process Shipping Documents in Accordance with Company Policy and
  Customer Requirements

4 Management Review

4.1 The Company’s Executive Management Team reviews the Quality Management
  and System Standard at least once a year. The purpose of the reviews is to
  assess the effectiveness and continuing suitability of the standard. The President
  of Nanmac is responsible for scheduling and conducting reviews. Conclusions of
  the reviews are recorded.

Section III
Quality System Policy

General Policy

This Quality System is the means by which all departments of Nanmac Corporation are united to
fulfill the mission of the Corporation. Producing quality products and services for our customers at
competitive costs and create a reasonable profit for our stockholders.

1 Scope

This Quality Management System sets the Standards of Quality for the Nanmac Corporation,
located at 11 Mayhew Street, Framingham, MA 01702, which manufactures temperature
sensing equipment for both industrial and research applications.
2 The Plan

2.1 The Plan requires a standardized method to buy raw material, inspect all purchased items, manufacture products in a consistent and controlled procedure and finally to inspect the end product so that it meets or exceeds our specifications as described in the current Nanmac handbook.

2.2 Custom Products

2.2.1 Our customers occasionally require major modifications to our standard products or variations thereof. Quality Systems must provide means to design, produce, and inspect these products also.

2.3 Workload

2.3.1 The ensuing sections of this manual delineate the responsibilities and the workload to specific departments to produce our objectives in a most efficient and economical manner. Obviously, improvements will be discovered in our procedures and the overall Quality System allow and anticipates that such changes will be made.

2.4 Documentation

All departments are required to document all important data and retain these records for future use and analysis by the Management Review Team (MRT). Some of these reports are forwarded to other departments for their use and information. Procedures are established to fill out appropriate forms in a standardized manner.

2.4.1.1 Communication with Customers

All important communications to or from our customers are forwarded to the appropriate department for action. Copies of all correspondence are kept in the customer’s file for future reference.

2.5 Responsibilities

2.5.1 The Management review Team (MRT) is responsible to see that all departments are working together efficiently. Also, the Management Review Team will meet twice a month to discuss any problems which arise regarding any phase of operations.

2.6 Structure

2.6.1 This Quality System Manual includes all levels of structure; namely overview of the Quality System, Quality Policies, Procedures and Work/Task Instructions were applicable and all required forms and Documentation.

2.6.2 Nanmac’s Quality Assurance Program meets the requirements of Mil-Q-9858A.
Section IV

Customer Requirements and Change Control

Many of Nanmac’s customers require products that are produced to their specific needs by modifying an existing Nanmac product. Our goal is to ensure that each customer order is built to their requirements. Our ordering process is divided into 3 processes to ensure a very high level of customer satisfaction. They are as follows:

- Standard or reorder of existing custom product
- New customer requirement
- Change to an existing customer custom product

1 Standard or Reorder of Existing Custom Product

a. Order is reviewed by the Sales Engineer, if the order is for a standard or reorder of an existing custom product with no changes the order is sent directly to the Production department.

b. The Production department will then pull the current design specifications, bills of materials and work procedures.

c. This package will then be assigned a job order number, which will include the quantity to be built. The Production department will then forward appropriate sections of the package to kitting, purchasing and assembly for order execution.

d. The Production department is responsible for coordinating information for customer delivery back to sales.

2 New Customer Custom Requirement

a. Request for quotation reviewed by Sales Engineering to define the specific requirements and obtains customer design documents specific to the order if they are available.

b. Sales Engineering meets with Mfg/Quality Engineering, Materials, and Production as required to scope out the custom requirement for build/test requirements and cost.

c. Sales Engineering will respond to the customer with a Nanmac proposal and ask for approval.

d. Once customer approval is received Mfg Engineering will finalize the design documentation and release to the manufacturing files.

e. The Production department will then take the released design documentation and execute the order. They will respond back to sales once all information is available for delivery.

3 Changes to Existing Customer Custom Requirement

a. Customer issues change request to Nanmac Sales Engineering.

b. Sales Engineering will review the request with Mfg Engineering.

c. Mfg Engineering reviews the change with Materials, Production and Quality to define the impact. The impact is given back to Sales Engineering.

d. Sales Engineering will get back to customer with the impact and ask for approval to implement the change. If there is no impact Sales Engineering will not contact the customer.
When approval is finalized Sales Engineering will instruct Mfg Engineering to issue an Engineering Change Notice when approved. Mfg Engineering will update the manufacturing files and take any other actions needed to insure the product can be built and tested.

Section V
Production Controls

Receipt of Materials and Services

1. Materials received by Nanmac shall be stored in a hold area until certification or inspection records are received. This area shall be isolated from the production area. This procedure applies for materials required in a production item and raw materials for stock.

2. When certification is received, inspection will proceed with the file on the particular contract, and a check of the physical and/or chemical analysis against the standard for that material. Any deviation shall be cause for rejection. Where certification does not conform with the QC, the item will be red tagged and the vendor will be advised. Repetitive occurrences will result in removal of the vendor’s name from the Purchasing Department list.

3. Inspection will verify and accomplish the following:
   a. The amount received against the quantity ordered.
   b. Visual inspection for damage in shipment or handling.
   c. The inspector will red-tag for damage and notify the receiving clerk to contact carrier for damage costs.
   d. If there is no visual defect, the inspector will check against the purchase order checklist to see all requirements are met.
   e. The inspector will check all dimensions and record on inspection report.
   f. After satisfactory inspection of all dimensions, the inspector will affix a green tag, sign and date it.
   g. If the dimensional checks are not satisfactory, a red tag will be affixed and the nature of the defects recorded. The inspection report will so state and the parts will be returned to the vendor.
   h. If the nature of the defects are minor and can be repaired, the repairs can be done at Nanmac, depending upon Nanmac’s and the vendor’s decision. The inspector will hold this material in the inspection room to await disposition from the vendor.
   i. After material rework, the parts will be re-inspected before acceptance.
   j. Once incoming materials have passed the requirements of inspection, they may be removed from the hold area and processed for production.

4. Inspection at Nanmac is accomplished on a 100% basis. Where volume or production require, sampling procedures will conform to the applicable portions of MIL-STD-105E as required in the purchase order.

5. Materials received by Nanmac Corporation that are of a perishable nature shall be logged in. When their shelf life has been exceeded, they shall be appropriately disposed of and noted in the perishable material log. These materials shall be used on a first-in-first-out basis.

6. Where complaints of “sub-standard” work are reported from a vendor, the following procedure will be in effect:
a The Material Review Board will evaluate the complaint.
b A representative of the Purchasing and/or QCM may visit the vendor to verify
the complaint; or the vendor may request a sample of the work to be returned
for evaluation.
c If re-work is required, the material will be handled in accordance with
paragraph 3.g and 3.h of this section and processed in accordance with
QC procedures that will best expedite return of the materials or parts.
d Adjustments will be made in the system or procedure to overcome any
inadequacy that may be revealed as a result of the complaint.

Material Handling and Storage

1 Material received for stock shall first be inspected in accordance with the applicable
procedures outlined in Section III. The materials shall then be tagged, boxed or
marked with the following information:
   a Material (grade, type, etc.)
   b Vendor
   c Date Received
   d Expiration Date if Perishable

   Tags placed on materials shall be firmly attached. Marked items shall have
identification over their entire length on several sides.

2 Repackaging of material will be done where necessary. Storage of all material will be
in a location best suited for that item. When an item has been logged in, its location
should also be shown.

3 All material shall be issued on a first-in-first-out basis. When applicable mfg. date of
shelf life should be noted. No outdated materials may be used.

4 Materials removed from storage should be so logged. If any portion of that material
is returned to stock, it should be so logged.

In Process Controls

1 The ship process sheets are an operational breakdown of approved manufacturing
and inspection procedures for each given part of assembly. In addition to the standard
shop process sheet (NMC-QC-36) a special shop process sheet (NMCQC-21) is
included for special parts or assemblies. These two shop process sheets contain
all the essential instructions for the performance of the contract and form a basis for
future cost estimates of a similar item.

2 All work is inspected 100%.

3 The shop process sheets are the medium for setting up manufacturing operations
in consecutive sequence and for establishing the points of inspection within a
group of operations.

4 With the process sheet, the drawings, specifications an applicable SOP’s, the
production technician will inspect the work at various pre-determined points of
manufacture.

5 If the production technician finds all dimensions etc. are as required, he will note
the process sheet by signature and date.

6 If a part is not within requirements but can be brought to size without major machining,
affix a tag stating the unfinished work and simultaneously notify the production department head for expeditious re-work. When the part has been reworked, it will be submitted to inspection.

7 If the work is beyond the specification limits and cannot be brought to size, the inspector will affix a red tag and notify the QC Manager and the production department head to prevent further rejects.

8 All parts which have been “red tagged” will require board analysis.

**Outgoing Quality Inspection**

1 Upon completion of parts, product sampling in most cases is 100%. In cases where volume exceeds 20 units, product will be sampled in accordance with Mil Std 105E.

2 Critical dimensions, electrical functionality, finish and required certifications will be checked and recorded on QOP-10-03-1.

3 Any deviations, sub-standard or incomplete work will be handled in the same manner as “in-process” work.

4 Each week the Quality Control Manager will prepare a report of work inspected and the results. This report will be submitted to the Plant General Manager to management analysis. CC to Eng. Mgr. And Production Mgr.

**Shipping**

1 All handling, packaging, and packing will be performed in such a manner as to protect the manufactured items while in storage and during transit as specified by the purchase order.

2 All shipped items will be accompanied by the completed shipping reports, inspection reports, special process reports, etc., as required in the purchase order.

**Section VI**

**Quality Assurance Controls**

**Tool, Gage, and Electrical Test Equipment Calibration**

1 All standard measuring instruments such as micrometers, verniers, height gages, depth micrometer, multimeters, etc., will be inspected upon receipt for compliance to the purchase order.

2 The inspector will take the next successive tool number from the log and apply the proper identification number to the instrument by use of an electric etcher vibrating tool where possible or an identification tag.

3 Standard measuring tools will be indicated as such in the description.

4 All tools, gages and electronic instruments will bear the prefix NM and then the number.

5 The inspector will fill out all the required information in the logbook for that tool, gage, or electronic instrument.

6 The inspector will initiate a gage record card entering all pertinent information as indicated. Gage cards are to be filed numerically.

7 If the inspector finds the instrument does not measure within the prescribed limits,
Defective Material Control

1 When an item does not meet the specification requirements and it cannot be repaired, it will be submitted to the Material Review Board. This Board will consist of the President, Quality Control Manager and Sales Engineer.

2 The Board must study the contract requirements to determine what action is to be taken. If in their opinion the functional intent or interchangeability is not impaired, a request for deviation is forwarded to the Contraction or Purchasing Agent.

3 No rework, repair, or replacement is to be made until approval is granted.

4 Defective product or material is to red tagged and placed in a restricted holding area until disposition by the Material Review Board has been finalized.

5 He will place a red tab on the instrument, describing the deficiency, and arrange for its return to the supplier.

6 The gage and instruments will be inspected in a manner consistent with good practices.

7 The inspection area will be well lighted, clear, and with temperatures as constant as possible.

8 Gage blocks or standards will not be moved from the checking area.

9 Gage blocks masters and standards will be returned to a recognized laboratory for calibration every 13 months. When results are obtained, a written report will be placed on file for future use. Blocks that show wear beyond the accepted limits will be replaced immediately.

10 Personnel have been instructed to return for a recheck any gage, which has been dropped or given rough treatment.

11 After use they are to be cleaned with a soft cloth and a thin coat of protective oil applied to prevent rust.

12 The inspector will post the number of times the tool is used on the Tool Gage Fixture Record Card. When the usage reaches the re-check point or if a three month period has lapsed, whichever has occurred first, then re-inspection procedure shall be in order and noted on the Record Card.

13 Tools supplied or owned by the Government will have the same handling and control procedure as outlined above.

14 Government owned tools are recorded on a standard log form.

15 Personal tools owned by employees, are not permitted to be used for product inspection.

Stamp and/or Signature Control

1 Several types of QC marking methods will be used, as required by the part size, to show each item has been inspected per the purchase order.

a Rubber stamp, for large parts and paperwork. The various types are noted below.

b Tags, for parts too small to stamp. However, the inspection stamp, part number, date, etc. shall appear on the tag. The part and tag may then be placed in a plastic bag.

c Types of stamps:

i Receiving

ii In-Process
Each stamp shall show the following on its face: NM (inspection number).

Each stamp number shall be assigned to an inspector and he will be the only person authorized to use it. Each inspector shall have one of each type of stamp to allow him to follow a product through all phases of production. The inspection stamp number shall be logged into an appropriate file.

**Special Process Control**

1. **Welding (Fusion, Resistance, Inert Gas, and Brazing)**
   a. All welders will have training in Thermocouple welding, which includes fusion welding, resistance welding, inert gas welding, and brazing that is specific to thermocouple products.
   b. Equipment used will be in accordance with the standards set up by an approved government agency.
   c. Control on quality is maintained by the following: visual surface condition, use of proper gas flow or electrical current, cutting and etching, X-ray for periodic inspection, test plates which have been sent to an independent test-house for certification and use of dye penetrant as an additional check for weld integrity.
   d. Each weld joint will be inspected and noted in an appropriate area in the inspection forms.

2. **Dye Penetrant**
   a. All welds and other types of materials, as specified and required by shop process sheets, are tested by the dye penetrant method.
   b. Only trained personnel will be permitted to perform this check.
   c. Results of this check will be noted on the appropriate inspection form.

(Leak testing-underwater at 80 psi - no bubbles after 1 min)

**Vendor Rating**

1. Vendors will be rated from the results of the receiving report, NMC-QC-30.

2. When a promised delivery date is established for an order and this date is met by the vendor, a score of 1.00 will be the rating for that order. For each calendar day that passes beyond the promised delivery date, a debit of .005 will be deducted from the factor of 1.00; for example, if a vendor is five days late in delivery his rating will be 5 x .005 or .025 deducted from 1.00 equals a rating of .975 for that order. An acceptable range is from .80 to 1.00.

3. The vendor’s quality rating is based on the number of inspection functions versus the number of functions that are rejected. For example, if a given part has ten inspection points and two are found that are not in accordance with the requirements, and are rejected, the resultant quality factor will be .80 etc. An acceptable quality factor must be .90 or greater.

4. Each rating, delivery and quality, will be posted on the vendor-rating chart. Adding the two singular factors will generate a composite factor and the resultant factor is divided by two.

5. Receipt of rejected material that must be returned to the vendor for re-work or replacement will not be considered for delivery rating until it has been returned as acceptable quality.
Record Retention and Trace-ability

1 When a job is completed the following records are kept in Nanmac Corporation for 7 years:
   1 Original Customer or Supplier Purchase Order together with all correspondence such as quotations, acknowledgments, certificate of compliance and chemical analysis.
   2 Copy of packing Slip
   3 All process, design drawings, bom’s and inspection reports generated by the job order number are filed in a complete package under the job order number.
   4 Material trace-ability information for wire and tubing is written on BOM used for the job order in the stamped trace-ability area.
   5 Additional records as required by the customer are filed with the job order.

2 Trace-ability at NANMAC is through the serial number that is etched on product where possible or the job lot number tag that is attached to product that can’t be etched. With this information we can access all design, process, inspection and component level information.

Standard Quality Control Forms

The following standard forms are used for receipt, handling, processing and inspection of materials or products and Nanmac Corporation. If required, special forms will be made up to allow for control of items not normally covered by our standard forms.

NMC-QC-20 Standard Inspection Procedure
NMC-QC-21 Special Shop Process Sheet
NMC-QC-26 Corrective Action Form
NMC-QC-28 Tool Gauge & Fixture Log
NMC-QC-29 Tool Gauge & Fixture Record Care
NMC-QC-30 Vendor Rating Chart
NMC-QC-44 Certificate of Conformance
NMC-QC-70 Quality Inspection Report Tag
NMC-QC-83 Design Change Request
NMC-QC-84 Engineering Release Form
NMC-QC-86 Receiving Inspection Report