EAC
No.145_1

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NONDESTRUCTIVE TESTING AGENCIES AND QUALITY CONTROL

145_1.1 General:

This advisory circular establishes the minimum requirements for agencies performing nondestructive testing (NDT), and covers also the general requirements for the establishment and maintenance of a quality control system for agencies engaged in nondestructive testing (NDT)

This advisory circular can be used as a basis to evaluate testing or inspection agencies, or both, and is intended for use in qualifying or accrediting, or both, of testing or inspection agencies, public or private, and recognizes the importance of establishing minimum safety criteria.

145_1.2 Referenced documents

(a) ECAA recognize and accept ASTM Volume 03.03 Nondestructive Testing Standards (as amended)

(b) ECAA recognize and accept EN 4179 as amended Qualification and approval of personnel for non destructive testing.

145_1.3 Definitions

(a) Agency means the public, independent, or in-house nondestructive testing organization approved by the authority to perform the examination (s) required by the purchase order or specification.

(b) Authority means the ECAA.

(c) Continuous quality improvement means an ongoing quality improvement activity for achieving results. Improvement may be directed at individual processes, finished products, or administrative processes. The continuous quality improvement program utilizes statistical methods, team projects, and other tools as appropriate to obtain and sustain improvements.

(d) Process Capability means the degree to which a process can produce the same results without variation that is reproducibility.

(e) Process control means managing a process to ensure that it is performing to its designed capability.

(f) Quality Control System means the organizational structure, responsibilities, practices, procedures, processes, and resources for implementing and maintaining the quality program.

(g) Quality Manual means a comprehensive document specifying organizational structure, practices, and procedures necessary to empower the quality policy and quality control system.

(h) Quality objectives means specific obtainable improvement goals supporting the quality program.

(i) Quality Policy means the overall intentions and direction of an organization regarding quality as formally expressed by top management.

(j) Quality Records means formal documentation of inspection results in data supporting the quality control system.

145_1.4 Applicability

The requirements mentioned in this appendix apply to independent, public, or in-house agencies to the extent required by the purchase order or specification, and does not apply to in-house equipment, methods, and examinations used for the exclusive purpose of internal process control, but apply to all examinations used for the final acceptance examination (s) if such examination (s) are required by the purchase order or specification.

This advisory circular states also the procedures for establishing and maintaining a quality system for nondestructive testing agencies, and a quality control system that provides for calibration, standardization, reference samples, inspection plans, and procedures.

145_1.5 Organization of the agency

The following information concerning the organization of the agency shall be provided by documentation:

(a) Description of the organization including:
  (1) The complete legal name and address of the main office;
  (2) The names and positions of the principal officers and directors;
  (3) The agency's ownership, managerial structure, and principal members;
  (4) The functional description of the agency's organization structure, operational departments, and support departments and services;
  (5) All relevant organizational officers of the agency and the principal officers of affiliates and directors of the affiliates where applicable; and
  (6) External organizations and organizational components and their functions that are utilized for significant technical support series.

(b) A listing of the relevant technical services offered.

145_1.6 Responsibilities and duties

(a) A nondestructive testing agency for one or more of the nondestructive test methods is responsible to ensure that:
  (1) It performs only examinations for which it is adequately equipped and staffed;
  (2) Its employees perform only examinations for which they are adequately qualified;
  (3) Its equipment is calibrated and personnel are certified in accordance with ECAR Part 65;
  (4) All equipment is properly maintained;
  (5) It informs the authority of any discrepancy or limitation imposed on the testing accuracy by such factors as surface finish form, shape, or procedure; and
  (6) The agency should perform all examinations in accordance with specified standards, and the agency should call to the attention of the authority at once any irregularity or deficiency noted in the documents and the authority reserves the right for disposition of non-complying material.

(b) The authority may, at its discretion inspect the procedures, equipment, and personnel qualification of the agency.

145_1.7 Human resources of the agency

(a) The agency shall document the following:
  (1) Written outline or chart defining operational personnel positions and their lines of responsibility and authority;
  (2) Summary job description for each professional scientific, supervisory and technical position category, documenting the required education, training, experience, or a combination thereof; and
  (3) Records or resumes that document the qualifications work experience, and training history of each person in a position described.

(b) The agency shall make available a description of its means of ensuring the continued competence of its personnel to perform NDT, including the maintenance of written records to document the results.

145_1.8 Personnel qualification

(a) Training, qualification, and certification of nondestructive testing personnel shall be in accordance with ECAR Part 65, and each agency shall establish minimum qualification requirements for NDT levels III, II, I and trainee.

(b) The personnel records of the Certified NDT individuals should contain, at least, the following:
  (1) Name of the certified individual;
  (2) Level of certification and NDT method (s);
  (3) Educational background and experience;
  (4) Documented history of training in accordance with the agency's personnel qualification procedure;
  (5) Results of the most recent visual acuity examinations;
  (6) Actual grades obtained in each examination;
  (7) Composite grade of all examinations;
  (8) Date of certification or re certification and expiration; and
  (9) A copy of his certificate.

145_1.9 Equipment for nondestructive testing

(a) The agency responsible for nondestructive examination of material should be equipped with, or have access to; at least the equipment listed below for the applicable processes.

(b) Nondestructive testing systems can include multiple examination stations with extensive supporting mechanisms and controls. Others may be simply utilizing only manual application of a basic instrument.

(c) Sections 1 through 6 in Appendix 1 contain some mandatory requirements and specifics for each NDT method. The basic requirements for a quality control system for manufacturing processes include:
   (1) Organization in appendix 2-1;
   (2) Human resources in appendix 2-2;
   (3) Physical resources and in appendix 2-3;
   (4) Quality control in appendix 2-4; and
   (5) Quality policy statement, planning, and administration Appendix 2-5.

APPENDIX 1

(a) Magnetic particle equipment

(1) Equipment for magnetization of parts shall be capable of inducing a flux density of sufficient intensity and direction to perform the required examination. Either AC or DC (full wave or half wave rectified) equipment or permanent magnets shall be used as specified by the contract, purchase order, or specification to produce the required magnetization:

(i) The part or section of the part may be magnetized by induction or by passing current through the part or section by permanent conductors, contact plates, clamps, or prods. After proper cleaning of the part, the magnetic particles may be applied either wet or dry;

(ii) The magnetic field is induced in the part by the use of any of the following:

(A) Yoke used to magnetize sections of parts. It is a U-shaped iron core with a coil around the cross bar or a U- shaped or flexible permanent magnet. The magnetic field across the open ends is used to induce a magnetic field in the part or section. The yoke's fixed or movable legs are used with the open ends in contact with the part. The yoke is normally operated by line voltage (110 to 220);

(B) Coil used to magnetize parts or sections. It is a current-carrying conductor formed into a coil of several turns. The magnetic field inside the coil is used to induce a magnetic field into the part or section;

(C) Prods used to magnetize sections of parts. They are rods, normally 0.5 to 1 in. (12.7 to 25.4 mm) in diameter and 8 to 10 in. (203 to 254 mm) in length, made of copper with a handle on one end. The ends of a pair of prods are placed on the part and current passed from one prod to the other through the part. The magnetic field is produced in the area between the prods;

(D) Clamps used to magnetize sections of parts. They are spring-loaded clamps with braided copper pads on the inside of the jaws. The clamps are clamped onto the part and a current is passed from one clamp to the other through a part; and

(E) Pads used in stationary equipment to magnetize parts. They are braided copper or lead pads placed at each end of the part. Current is passed from one pad to the other through the part. Pads are normally used with stationary equipment and rigged so that the pads are in contact with the part under pressure.

(iii) The coils, prods, clamps, and pads are energized with high-amperage low-voltage current. Therefore, equipment must be available to transform line current and, when required, to rectify it. The equipment should contain an ammeter to indicate the magnetizing amperage, suitable switches, and, when required, timers to control the length of time that the current is applied. If different amperages are required, the equipment shall produce the maximum required amperage with a suitable control for reducing the amperage to the required lower levels. Cables should be of adequate but not excessive length and large enough to carry the required amperage;

(iv) Magnetic particles may be applied either wet or dry. Dry particles should be applied uniformly with a dusting or light blowing action. Wet particles should be applied by aerosol cans or by hosing. Provisions should be available to assure that the required amount of particles is in suspension when the spray is applied and to periodically check the concentration of the solution; and

(v) Adequate lighting shall be available when the parts are viewed for indications when fluorescent dyed particles are used, ultraviolet light (3200 to 3800 A (320 to 380 Nm)) must be available. Adequate white light must be available when viewing visible dyed particles and should be available for use, as needed, when viewing fluorescent dyed particles.

(2) Equipment for demagnetization should be capable of demagnetizing all part configurations, to the minimum residual field specified in the specification or purchase document, regardless of size and configuration. Demagnetization is normally accomplished by stepping down AC or DC voltage while the direction

of the DC is changed between each step, or by which drawing the part from an AC field. Demagnetization can be accomplished by induced fields or by passing a current through the part. Induced fields using coils are generally the most effective method. Facilities should include a coil, cables (when required) and equipment to produce adequate voltages and amperages, reversing and step-down switches, and a meter to indicate residual external magnetic fields.

(b) Radiographic equipment

(1) Radiation Source: The radiation source shall be capable of producing sufficient energy and intensity to examine materials in accordance with required specifications. Either X rays or gamma rays may be used unless otherwise specified by the contract, specification, or purchase order:

(i) X- ray equipment should contain voltage and amperage controls (when applicable) and meters, a timer to time the length of the exposure, or other approved controls, and provisions for positioning the tube head and the part being X rayed (when applicable). The voltage and amperage range of the equipment must be adequate to penetrate the thickness of the material to be evaluated and produce acceptable film densities; and

(ii) Gamma rays are produced by radioactive materials, such as cobalt-60 and iridium-192. Different isotopes emit gamma rays in a specific energy range. The isotope (size, energy level, and strength) should be selected in view of the application (material, thickness, required pentameter sensitivity) and a reasonable exposure time.

(2) Safety and monitoring equipment consistent with good practice and current regulations should be available and normally includes safety switches, survey meters, film badges, dosimeters, signs, ropes, lead - lined room, etc., as applicable. Also, lead sheet shot or leaded rubber should be available to control or reduce scattered radiation. Pentameters (image quality indicators) are used to evaluate the sensitivity of both setup and processing techniques. They must be made from material that is radiographically similar to, and that represents the specified percentage thickness of the material to be evaluated. The pentameters must be clean and properly identified. Blocks shall be available on which the pentameter can be placed during the exposure, if required. The thickness of the blocks should be approximately equal to the thickness of the sections being radio graphed and radio graphically similar. When exposing no homogeneous specimens such as electronic components or other complex structured devices, the pentameters shall be used only as image-quality indicators (IQI's), and shall be selected to produce similar image densities to that of the area of interest of the device being radio graphed. Lead numbers and letters of adequate size and thickness should be a sufficient number of each letter and number to number to put all required identification on the film. However, alternative methods of permanent film identification are permitted. Examples are light box exposures and permanent white ink.

(3) Recording medium: The recording medium, that is, film, fluoroscope, etc., shall be capable of recording or displaying an image to the sensitivity and contrast required by the applicable specification, purchase order, or contract. Film, or paper if permitted, should be stored in a cool, dry place that is completely protected from direct or scattered radiation (background radiation excluded). Various types of intensifying screens are used in industrial applications, with the most common being lead compound (or lead oxide) and fluorescent. When intensifying screens are used in industrial applications, they should be clean and free of scratches, wrinkles, surface contamination, and any other conditions that may interfere with the production of a quality radiograph. - Processing equipment, such as darkroom facilities,

(4) Processing equipment: Densitometers, etc., shall be adequate to ensure that the quality intent of the applicable specification is maintained:

(i) A darkroom or other suitable facility must be available to handle film when loading exposure holders, cutting preloaded strip film, and when removing the film from the holder for processing. The darkroom should be equipped with both safe and white lights and a work area to handle the film;

(ii) When hand-processing equipment is used, facilities must be available to process the film, in developer solution, stop bath or fresh water rinse, in fixer, and in a final fresh water rinse (preferably not the rinse between develop and fix), and should include the use of a film dryer and a timer with an alarm. A time/temperature relationship for film processing must be maintained;

(iii) When automatic processing equipment is used, it must be clean and time/temperature relationships and replenishment rates must be maintained; and

(iv) Facilities for viewing the radiograph and for measuring photographic or optical density must be available. The viewing equipment should include both high and normal intensity lights or separate viewers. A light transmission and a reflection-type densitometer should be available to measure film density.

(5) Reference Standards: Reference standards must be in accordance with authority-furnished standards or specifications or both.

(c) Liquid penetrant equipment

(1) Liquid penetrant inspection equipment consists of the necessary apparatus to apply the penetrant, wash the surface of the part, dry the part, and apply a developer, and a properly lighted area in which the part can be inspected. There are two basic liquid penetrant methods and three types of penetrant systems. Each system requires slightly different facilities and apparatus for proper processing of parts. The two liquid penetrant methods are fluorescent and visible. The three types of penetrant systems are water washable, posy-emulsified and solvent removable.

(2) Equipment generally consists of either immersion dip tanks or spray apparatus (spray guns, aerosol cans, etc.) or brushing arranged in a logical order to allow for smooth flow of parts when the applicable sequence of operations (penetrant application, dwell, penetrant removal, drying, developing, examination) are followed as specified in Practice E 165 or other contract document.

(3) Adequate lighting shall be available when the parts are viewed for indications. When fluorescent dyed particles are used, ultraviolet light (3200 to 3800 A (320 to 380 nm)) must be available. Adequate white light must be available when viewing visible dyed particles and should be available for use, as needed, when viewing fluorescent dyed particles.

(d) Ultrasonic equipment

(1) Ultrasonic Instrumentation: The ultrasonic instrumentation shall be capable of generating and detecting pulsed ultrasonic energy over an adequate frequency and power range to ensure proper examination in accordance with the applicable governing specification. The instrumentation and accessories should include, when applicable ultrasonic unit, search unit, tank, bridge, recorder, coupling, and reference blocks:

(i) Ultrasonic Unit: This unit should include a pulser circuit, receiver circuit, CRT display or acceptable equivalent signal display;

(ii) Search Unit: The cable, search unit, and search tube (when immersion scanning is required);

(iii) The ultrasonic unit and search unit as a system should meet the performance requirements of the authority; and

(iv) When immersion testing is required, a tank or bubble system is necessary to furnish a water path between the search unit and the part. The tank; should be equipped with a bridge and a manipulating system to hold the search unit. The bridge should be of sufficient strength to provide rigid support for the manipulator.

(2) Reference Standards:

(i) When reference blocks using flat-bottom holes are required, the holes should be processed and monitored in accordance with the requirements of Part 145;

(ii) When contoured surfaces are to be examined, reference standards conforming to the general geometry of the part or section should be used; and

(iii) Reference standards must be in accordance with authority-furnished standards or specifications, or both.

(e) Leak testing

(1) Equipment:

(i) Helium leak testing requires a mass spectrometer that is peaked for helium and that has a sensitivity of at least one decade less than the minimum leakage rate being tested. Pressure chambers capable of withstanding positive and vacuum pressure chambers may be required for some methods;

(ii) Radioisotope leak testing requires a tracer gas pressurization system that has been approved and licensed by the appropriate state or federal agencies, or both, Also scintillation crystal detectors and Geiger Mueller counters are required which are capable of detecting emissions of the tracer being used;

(iii) Halogen leak testing requires standard probe-type halogen leak detector; and

(iv) Bubble leak testing requires baths of the appropriate size that are capable of heating the detector fluid to the specified temperature. Also, pressure vessels may be necessary for pressurization of the test specimens prior to immersion in the detector fluid.

(2) Reference Standards:

(i) The helium leak standard shall have a leak rate at least as small as the limit being tested;

(ii) The Krypton 85 standard shall be encapsulated in the same type glass, wall thickness, and geometrical shape as the sample vials used to determine specific activity; and

(iii) The halogen standard, with the response correction factor, shall be so contoured that the maximum leak will read on the upper 9/10 of the scale.

(f) Electromagnetic (eddy-current) equipment

(1) Electronic Apparatus: The electronic apparatus shall be capable of energizing the test coils or probes with alternating currents of suitable frequencies and power levels and shall be capable of sensing the changes in the electromagnetic response of the sensors. Equipment may include a detector, phase discriminator, filter circuits, modulation circuits, magnetic-saturation devices, display (recorder, scope or meter, or both) and signaling devices as required by a particular application.

(2) Test Coils: Test coils may be of the encircling or probe-coil type and shall be capable of inducting an electromagnetic field in the test specimen and standard and sensing changes in the electric and magnetic characteristics of the specimen.

(3) Standards:

(i) Sorting Standards-In sorting, known reference standard (s) are required. Refer to Practices E703 or E566 for requirements;

(ii) Coating Thickness Measurements standards- calibration standards of uniform thickness are available in either of two types: foil or coated substrate. Refer to Practice E376 for requirements;

(iii) Conductivity Standards:

(A) Primary Standards: Those standards which have a value assigned through direct comparison with a standard calibrated by National Bureau of Standards or have been calibrated to NIST. The primary standards are usually kept in a laboratory environment and are used only to calibrate secondary standards.

(B) Secondary Standards: Those standards supplied with the instrumentation or standards constructed by the user for a specific test. These standards are used to calibrate the instrumentation during most examination of materials.

(iv) Discontinuity Standards: The standard used to adjust the sensitivity of the apparatus shall be free of interfering discontinuities and shall be of the

same nominal alloy., heat treatment, and dimensions as the products to be examined. It shall be of sufficient length to permit the spacing of artificial discontinuities to provide good signal resolution and be mechanically stable while in the examining position in the apparatus. Artificial discontinuities placed in the product to be examined shall be one or more of the following types: Notches: may be produced by Electric Discharge Machining (EDM), milling, or other means, Longitudinal, transverse notches, or both may be used. Orientation, dimensions, configuration, and position of the notches affect the response of the eddy current system.

APPENDIX 2

(a) Organization

(1) The following information concerning the organization of the agency shall be documented: A description of the organization including:
  (i) The complete legal name and address of the main office;
  (ii) The names and positions of the principal officers and directors;
  (iii) The agency's ownership; managerial structure, and principal members;
  (iv) The functional description of the agency's organizational structure, operational departments, and support departments and services. This may be demonstrated in the form of charts that depict all the divisions, departments, sections and units, and their relationships;
  (v) All relevant organizational affiliates of the agency and principal officers of affiliates and directors of affiliates where applicable;
  (vi) External organizations and organizational components and their function that are utilized for significant technical support services; and
  (vii) A brief history of the agency including its relationship with its organizational component affiliations and other supporting information.

(2) A listing of the relevant technical services offered.

(3) A list giving applicable dates of qualifications and accreditations.

(b) Human resources

(1) General: Those aspects of the quality system where the work of the employees will affect the quality of products shall be identified, and specification taken to control them.

(2) Management responsibilities: The quality-related requirements, duties, and responsibilities of all personnel should be identified. Job criteria that are quality-related should be specified in job descriptions to permit proper employee selection.

(3) Employee selection and training: Employees shall be selected on the basis of capability and experience or the potential to fully qualify for the job. A training program shall be maintained to ensure employees develop and retain skill competence. Training, qualification, and certification of nondestructive testing personnel shall be in accordance with Part 65.

(4) The agency shall provide the following documentation:
  (i) A written outline on a chart giving operational personnel positions and their lines of responsibility and authority, and
  (ii) A summary job description for each professional, scientific, supervisory, and technical position category including the required education, training and experience, certification, or professional license.

(5) The agency shall provide a description of its methods of maintaining personnel records to document the qualifications, work experience, and training history of each person in the position described in Part 145. The agency shall also provide a description of its means of ensuring confidence in its human resources including the maintenance of records.

(c) Physical resources

The agency shall provide an inventory of its relevant physical resources including:

(1) A general description of the agency's facilities for NDT related activities;

(2) An inventory of equipment used to perform NDT including the following for each item of equipment:
  (i) Type of equipment and use;
  (ii) Name of manufacturer;
  (iii) The equipment model and serial number;
  (iv) Properties of the equipment subject to standardization or calibration;
  (v) The range of operation and range of calibration;
  (vi) Reference to a recognized calibration procedure;
  (vii) Frequency of calibration; and
  (viii) Allowable tolerances or maximum sensitivity.

(3) A system of written procedures for each NDT service performed by the agency. The procedures shall include a description of the method used for NDT and the

methods used for data recording, data processing, data reporting, and for certification of the results. When required, customer approval shall be obtained.

(4) An inventory of reference material including a library of standards, applicable technical publications, and pertinent specifications and amendments.

(d) Quality control

(1) Control of purchased NDT equipment, materials, and services:

(i) General: The quality control system shall include procedures to ensure effective supplier quality management for all purchased materials and services. Controls shall be provided for materials, equipment, and any subcontracted services;

(ii) Supplier quality program and selection method: Procedures shall be established for the selection and qualification of suppliers, such as supplier surveys, past quality history, and industry history Each supplier's quality capability shall be periodically evaluated, including audit visits where appropriate, based upon performance shall be established in the purchase agreement. The purchase agreement should include the elements of the quality control system that are to be performed by the supplier in assuring quality;

(iii) Receiving inspection: For those purchased items where inspection upon receipt is acceptable, inspection of submitted items shall be performed to the degree and extent needed to determine acceptability. Receiving inspection shall include well-maintained records so that past supplier performance is available. Adequate facilities and procedures for storage, handling, protection, and controlled release of purchased materials shall be established. Materials inspected, tested, and approved shall be separated from withheld or rejected materials;

(iv) Nonconforming material control: Control of non-conforming purchased supplies or equipment shall be maintained to ensure that such items are not used; and

(v) Subcontracted Services: When the agency utilizes the services of another agency to perform all or part of its services, provisions shall be made to ensure that the activities are performed in accordance with the purchaser's requirements. Actions to be taken shall be included in the agency's quality assurance manual. The requirements of Guide E1359 shall be used as a guide in evaluating the quality system of the subcontracted agency.

(2) Measuring and test equipment:

(i) Measuring and test equipment shall be of the type, range, accuracy, precision, stability, and resolution appropriate for its intended use;

(ii) Measuring and test equipment shall be calibrated and controlled to ensure accuracy of measurement of product and processes to specified requirements. A calibration system shall be established to ensure that measuring and test equipment are maintained by periodic calibration against certified equipment traceable to nationally recognized standards and serviced so that equipment will function properly and is within prescribed limits; and

(iii) The calibration system shall be an integral part of the quality control system that will ensure the quality of the product or services provided. The calibration system shall be documented and shall require that the appropriate records be maintained to substantiate conformance with specified requirements.

(3) Document control: All examinations shall be performed in accordance with instructions, procedures, or other documents appropriate to the circumstances. All such work instructions, procedures, specifications, and drawings shall be reviewed for correctness and adequacy prior to release to the appropriate workstation. The system shall ensure that correct revisions of applicable documents are available for use at the locations where the activities affecting quality are performed. The system shall also provide for the timely recall of obsolete documents.

(4) Handling, storage, and shipping: Factors potentially affecting the quality of items being tested as they move within the activity or on their way to the

customer shall include handling damage, corrosion or infestation, degradation, loss from vandalism, and loss or obliteration of identifying markings. Methods for ensuring quality during handling, storage and shipping include:

(i) Control of handling methods: Use of established methods to prevent handling damage, such as special containers, environments, or vehicles;

(ii) Item Audit-Periodic audits of stored items to ensure against deterioration or expiration of shelf life;

(iii) Control of Shipping Methods - Monitoring shipping procedures to ensure that transit requirements are met and that required shipping documents are used; and

(iv) Environment Control-Review of procedures maintaining special protective environments, such as temperature, moisture, or gas pressure.

(5) Records:

(i) Types of Quality Records - Basic information for an effective quality system shall include, where appropriate:

(A) Product identification to allow traceability of what has been examined, which materials and equipment used, by what operation, and on what date;

(B) Examination and quality control procedures, with applicable standards, checks, and tests. These are the working instructions of the quality control system;

(D) Records as evidence that the prescribed examinations have been performed and results thereof; and

(E) Identification and recording of rejected product with assurance that it had been properly reported to the customer.

(ii) Content and use of records: All quality records shall:

(A) Be current, complete, accurate, legible, and pertinent. Showing (where required) information such as identification and quality of product examined, date examination procedures followed, and examination results;

(B) Contain the date of origination of the records;

(C) Be traceable to product, process, or production period;

(D) Where required, be identifiable as to individuals responsible for their preparation;

(E) Where required, show quantity, type, and severity of discrepancies found; and

(F) Be retained in accordance with a stated record retention policy, so as to be available for periodic independent reviews as may be needed to comply with the customer's contractual requirements. Protection from fire, theft, pilferage, and water damage shall be considered.

(6) Process control:

(i) Control of operations: The quality control system shall ensure that all required operations are performed in the specified manner and sequence. Operations should be defined to the maximum practical extent by documented work instructions. Exceptions made to provide for details of common practice should be limited;

(ii) Receipt of item: Items shall be inspected upon receipt to ensure they are the items specified in the customer's order. Records shall be maintained of this inspection, traceability data (such as lot, batch, heat, or other identification), shall be recorded; and

(iii) Special process control: Processes having parameters that affect results require special controls. To ensure adequate control of these processes, the following procedures shall be considered:

(A) Periodic verification of accuracy and variability of the equipment used in examination of the product, for example, standardization of ultrasonic testing: (UT) equipment;

(B) Periodic verification of the continuity capabilities of operators to meet specific process quality requirement; and

(C) Periodic verification of special environments, times, temperature, or other factors affecting product quality; for example, solution control for radiographic testing (RT) film processors.

(iv) Control of Item Status: The quality control system shall clearly identify the status of material and assemblies. Such identification may take the form of stamps, tags, or notations on travelers or records that accompany the items.

(7) Control of nonconforming material:

(i) Measures shall be established to identify and control: Nonconforming material. Controls shall apply to items that do not comply with acceptance criteria and to Nonconforming equipment or material. Nonconforming items shall be as follows:

(A) Identified with a clear mark, such as using a " HOLD" tag or stamp;

(B) Segregated in a designed holding area, where practical, with access restricted to those authorized to make disposition; and

(C) Reviewed by a clearly defined authority designated by management and customer requirements.

(8) Corrective action: The agency shall have a system to ensure that repetitive corrections adverse to the quality of the agency's work are identified and corrected. The method to be used shall be documented in the agency's quality manual. The corrective action program should be extended to suppliers as appropriate.

(9) Continuous quality improvement:

(i) Continuous quality improvement should be used to maintain satisfactory performance levels, as defined by the customer's satisfactory performance levels, as defined by the customer's requirements, as well as to obtain lasting improvements. In some instants, improvement action might be maintaining or returning to previous levels of performance. In other instances, the data analysis may support a "breakthrough" and allow achieving improved performance. Examples would include the following:

(A) Analysis of calibration data obtain the optimum calibration cycle;

(B) Analysis of data to identify inconsistent performance. Note that inconsistent performance does not always mean unacceptable performance; and

(C) Analysis of data to identify opportunities to improve process.

(ii) Preventive action: Through use of data analysis (statistical techniques) it may be possible to identify and eliminate root cases of problems; and

(iii) A procedure shall be developed to focus on the quality improvement effort so that it is used to maximum benefit.

(10) Interface with other quality control systems:

(i) When the agency is part of a larger operation, the quality control system supports the larger (parent) system. Through the parent system may be supporting separate quality specification, those specifications usually provide for the nondestructive testing agency to operate as a separate agency; and

(ii) Data collected by the nondestructive testing agency may serve as primary source for data analysis by the customer. Whether the customer is internal or external, provision needs to be made to support the customers requirements for data analysis.

(e) Quality policy statement, planning, and administration

(1) Policy statement: A policy statement shall describe management's specific intention and policy with respect to quality. The policy statement should specify an organized approach for carrying out those intentions and should address itself to all major quality parameters. It should be approved by the chief executive officer for company-wide policies or by subordinate officers for specialized policies. Periodic audits should be required to ensure adherence to quality policies.

(2) Quality objectives: Objectives should be established for appropriate key elements of performance such as safety requirements, internal performance levels, vendor performance, training, and qualification of personal.

(3) Quality control system: A quality control system shall be established that will carry out the stated policies and objectives.

(4) Quality planning: Planning for each new or modified process or test method should define those characteristics to be controlled.

(5) Quality manual: The quality policy and system shall be documented and be in accessible form, such as a quality manual or series of manuals. Key elements should include, as necessary:
  (i) The general quality statement;
  (ii) A description of the quality system;
  (iii) A general description of quality planning requirements with specifies for each product category where appropriate;
  (iv) The requirements of Practice E 543 pertaining to the laboratory procedure manual; and
  (v) Typical used examination procedure.

(6) Administration: Clear lines of authority shall be established to administer the quality control system:
  (i) Quality responsibility: The quality responsibility of each unit within the organization shall be approved by the chief operation officer of each unit;
  (ii) Quality performance reporting: Responsibility for reporting performance against stated quality objectives to higher management should rest with functions independent of those responsible for the attainment of those objectives. Procedures for documentation and record retention should be established; and
  (iii) Quality system audits: To provide assurance, a periodic audit of the quality control system should be made by an organizational element independent of the unit being audited or by a qualified third party. It may include, as appropriate:
    (A) Management audits to determine how well quality policy and objectives are being met;
    (B) System audits, including testing process audits to determine how well quality planning has been implemented and to identify areas where changes would be beneficial to the quality services performed; and
    (C) Records documenting findings and corrective and preventive actions taken.