MILITARY SPECIFICATION

PROGRAM REQUIREMENTS, NONDESTRUCTIVE INSPECTION, FOR WEAPONS SYSTEMS, SUBSYSTEMS, PARTS AND MATERIALS

This specification is approved for use within the Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification provides requirements for establishing a nondestructive inspection program for the life cycle of weapons systems, subsystems, parts and materials.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

MIL-M-38780 - Manual, Technical, Nondestructive Inspection

STANDARDS

MILITARY

MIL-STD-410 - Nondestructive Testing, Personnel Qualification and Certification

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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials Technology Laboratory, ATTN: SLCMT-MEE, Watertown, MA 02172-0001 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

/AREA NDTI/

AMSC N/A

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(Copies of specifications, standards, handbooks, drawings, publications, and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.1.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Preparation of nondestructive inspection plan. A life cycle NDI plan shall be prepared in writing, by the contractor for approval by the government. The NDI plan shall be sufficiently comprehensive to enable the government to exercise its approval authority for the Plan. It shall define nondestructive inspection requirements and considerations for definition, design, engineering development production and maintenance during deployment. The Plan shall clearly substantiate that the contractor has adequately evaluated his system design in terms of overall NDI requirements for the entire system life cycle.

3.1.1 Objective. Nondestructive inspection detection capability shall be considered by the prime contractor during all phases of the systems life cycle including especially manufacturing, and maintenance after deployment. The objective of the plan is to assure a level of nondestructive inspection capability and confidence consistent with the prime contractor's design requirements. Acceptance criteria shall be based upon principles of fracture mechanics to the maximum extent possible.

3.1.2 Applicability. This plan shall include and be applicable to all components as specified in the system specifications and produced by the prime contractor, subcontractors, and suppliers under Government contract.

3.1.3 Production requirements. The Plan shall discuss any production NDI requirement considered beyond the state-of-the-art and needing development and/or special study. Proposed production NDI methodology shall be documented as capable of reliably detecting initial flaw sizes, defects, and tolerances associated with the planned production methods of manufacturing, fabrication, and assembly. The thrust of the production NDI program is the assurance that the initial manufactured quality of the system meets the design requirements for fatigue, structural integrity, and damage tolerance.

3.1.4 Particular parts. The Plan shall discuss the contractor's NDI program as it relates to the inspection of materials, parts, subsystems, and systems structural and/or non-structural.

3.1.5 Training. The Plan shall discuss the contractor's approach to the utilization of certified NDI technicians during production of the system. Inspection personnel of the prime contractor, subcontractor and outside agency shall be trained, examined, qualified and certified in accordance with MIL-STD-410 before conducting the specified NDT inspection.

3.1.6 System peculiar NDI equipment. The Plan will discuss requirements for system peculiar NDI equipment and availability, reliability and maintainability.

3.1.7 Control of subs/vendors. The prime contractor shall implement procedures sufficient to assure that subcontractors and vendors comply with the requirements of the specification. These procedures shall include NDI program surveillance so as to identify, report and resolve NDI problems, difficulties or delays which may adversely impact the program.

3.2 Documentation. The following documents shall result from the implementation of the nondestructive inspection program.

3.2.1 Nondestructive inspection plan. The contractor shall provide a nondestructive inspection plan which describes the contractor's approach and recommendations for the use of nondestructive inspection during all phases of the weapons systems life cycle as detailed below. This plan shall be coordinated with other applicable plans (e.g. aircraft structural integrity plan, integrated logistic support plan, logistic support analysis, reliability and maintainability plan, etc.) when such plans are part of the contractual requirement. Such a plan shall be submitted to the cognizant Government design agency for approval.

3.2.1.1 Conceptual or proof of principle phase shall include but not be limited to:

a. Identify all materials for use on the weapon system.

b. For each material and material application, identify candidate nondestructive inspection procedures.

c. Identify applicable trade-off studies inter-relating materials, inspection methods, frequency of inspections, costs, etc.

d. Assure that Systems, Subsystems, parts and materials are designed/selected such that critical flaws are within the detection limits of applicable nondestructive inspection methods.

e. Initiate development of inspection equipment specifications if specialized and not available.

3.2.1.2 Demonstration and validation or proof of principle phase shall include, but not be limited to:

a. Develop quality assurance provisions with nondestructive inspection requirements for execution during full scale engineering development.

b. Use military authorized general purpose NDI equipment if possible. Request specific justification for special NDI equipment if required.

c. Identify reliability, availability and maintainability (RAM) requirements, for new nondestructive inspection support equipment.

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d. Coordinate design requirements and nondestructive inspection procedures.

3.2.1.3 Full scale development or development proveout phase shall include, but not be limited to:

a. Conduct a materials and parts classification (see paragraph 3.2.1.3.1).

b. Use existing probability of detection (POD) curves, if available for manufacturing and maintenance areas. If none exist or they are incomplete, develop POD curves for manufacturing and maintenance inspection procedures.

c. Develop unusual nondestructive inspection procedures.

d. Initiate development of nondestructive inspection manual using instructions contained in MIL-M-38780.

e. If no general purpose calibration standards are available, develop calibration standards and procedures.

f. Identify the level of personnel training and certification required using MIL-STD-410.

3.2.1.3.1 Materials and parts classification. The contractor shall classify all components of the weapons systems according to the design requirements of the applicable design agency. Complex components may be divided into zones and a separate classification or quality grade assigned to each zone. Classification shall be noted on the drawings of the component or other released engineering data. Components shall be classified as follows:

Class 1 - Components which are fracture or fatigue critical or components the single failure of which would cause significant danger to operating personnel or would result in an operational penalty. This includes loss of major components, loss of control, unintentional release, inability to release armament stores, or failure of weapon installation components.

Subclass 1A - A subclass 1A component is a safety of flight component, the single failure of which would result in the loss of an aircraft or missile system.

Subclass 1B - Components subject to fracture and fatigue but not included in Subclass 1A.

Class 2 - All components not classified as Class 1.

3.2.1.4 Production phase shall include but not be limited to:

a. Verify that specified nondestructive inspection procedures are adequate to meet design requirements during initial production.

b. Monitor and coordinate changes in nondestructive inspection requirements, procedures and equipment resulting from engineering change proposals or production changes.

c. Implement production/manufacturing nondestructive testing and inspection procedures, including qualification and certification of production inspection personnel.

d. Maintain inspection records and records of Material Review Board recommendations for NDI requirements for new components or improved methods/procedures for existing inspection requirements.

e. Expand and continue development of the technical data packages, specifically the nondestructive inspection manual, in coordination with logistic support analyses, maintenance plans, etc. This phase includes identification and recommendation of procedures that are supportable only at particular maintenance levels.

f. Demonstrate RAM capabilities of new nondestructive support inspection equipment.

3.2.1.5 Deployment phase shall include but not be limited to:

a. Describe and recommend methods of controlling changes in nondestructive inspection requirements resulting from operational experience.

b. Support the implementation of maintenance/in-service nondestructive inspection procedures at all levels of maintenance specified in the maintenance plans.

c. Support and verification of nondestructive inspection procedures and recommend action necessary to solve any problems identified.

3.2.1.6 Disposal phase shall include but not be limited to:

a. Identify any nondestructive inspection requirements that might be necessary prior to disposal of the weapons system or reclamation of portions from it.

b. Assess feasibility of using system peculiar nondestructive inspection equipment, standards, etc. resulting from the current program on other still operating systems or for future programs.

c. Identify areas which can be used for training purposes to enhance the practical skills of NDT inspectors.

3.2.2 System peculiar nondestructive inspection technical manual. The contractor shall prepare a system peculiar nondestructive inspection technical manual using instructions contained in MIL-M-38780. This manual shall detail the procedures for nondestructive inspection to be utilized by personnel in the organizational, intermediate and depot levels. This document shall be prepared in accordance with specifications provided by the procuring activity.

3.2.3 Hardware requirement. When required, the contractor shall furnish one or more sets (as established by the procuring authority) of all specifications, probes, transducers and specialized equipment to the military agency responsible for the weapon system.

3.3 Schedule for submission.

3.3.1 Nondestructive inspection plan. The initial draft of the NDI plan shall be submitted to the government procuring activity as a part of the proposal package. The preliminary plan shall be updated and submitted for approval sixty (60) days subsequent to contract award. The final plan shall be submitted for government approval 60 days prior to the system critical design review (CDR). When approved by the government at CDR, the NDI plan shall implement the contractor's NDI program for the production, operation, and maintenance of the system.

3.3.2 Nondestructive inspection manual. Unless specified otherwise a preliminary nondestructive inspection manual shall be prepared prior to Government acceptance of the weapon system and the formal manual shall be prepared prior to delivery of the first operational weapon system.

3.4 Government Nondestructive inspection advisory board.

3.4.1 Responsibility for implementation. The program manager shall assemble a government team of advisors to provide consultation on all aspects of the nondestructive inspection program.

3.4.2 Board membership. The board shall be chaired by a technical representative of the procuring activity and include technical representatives from the contractor(s). The board shall include members from Government and contractors organizations as follows:

a. Government members. The Government members shall be as designated by the applicable program manager in accordance with applicable directives. The Board shall include a representative from the Product Assurance Directorate, who is knowledgeable in the field of nondestructive inspection and testing.

b. Contractor Members. Contractor members shall be representatives of the contractors organizations empowered with sufficient authority to act on behalf of their organization. They shall ensure that proper inspection techniques and equipment are developed to produce and maintain the weapon system.

3.4.3 Duties.

3.4.3.1 Primary function. The prime function of the Advisory Board shall be to interface with the contractors Nondestructive Inspection Technical Requirements Review Board (Contractor's Team) to ensure that the goals of the Nondestructive Inspection Program are attained. The Advisory Board shall monitor the contractor's activity during all phases of the weapon system program and shall act on behalf of the Program Manager.

3.4.3.2 Contractor reviews function. The Advisory Board shall meet on a regularly scheduled basis as deemed appropriate by the chairman. These meetings shall be convened to review contractor(s) facilities, and design, development and application activities relating to nondestructive inspection techniques and equipment.

3.4.3.3 Recommendation function. The Advisory Board shall document all findings and recommend appropriate action to be taken by the Program Manager to resolve any issues or problems.

3.5 Contractor's nondestructive inspection technical requirements review board (contractor's team).

3.5.1 Responsibility for implementation. The contractor shall assemble appropriate competent technical personnel to develop and implement the nondestructive inspection plan.

3.5.2 Board membership. The membership of the contractor's team shall include representation from the project design, materials and process engineering, operations/manufacturing, quality control, material/component procurement, and contract functions. This representation is intended to be flexible and the recommended membership may be altered depending upon the size of the contract and the internal structure of the contractor. A chairman shall be designated with signature authority and shall be the contractor's focal point for the NDI program.

3.5.3 Duties.

3.5.3.1 Primary Function. The contractor's technical review board shall support the preparation of the NDI Plan and implement it after Government approval. Duties requiring special emphasis shall include, but not be limited to:

a. Determination of nondestructive inspection requirements for those components identified in 3.2.1.3.1 to ensure that the most appropriate inspection technique(s) have been selected for the components being tested, and that the level of inspection is commensurate with the quality required.

b. Determination of rejectable defect size, location and orientation, along with the inspection procedure number, the process specification number or other released engineering documents as appropriate.

c. The Contractor's Team shall ensure that the documents outlined in 3.2 are prepared and submitted in accordance with the established schedule.

d. The Team Chairman shall schedule periodic meetings, as required, to resolve problems as they occur. Other meetings may be convened whenever team action is required.

e. The Contractor's Team chairman shall be a member of and meet with the Government NDI advisory board.

3.6 Preparation of inspection procedures and specifications.

3.6.1 Contractor NDI process specifications. The contractor shall not use general NDI process specifications or contractor NDI process specifications for specific inspection procedures as sole controlling documents. The general NDI process specifications reflect the minimum quality requirements and, of necessity, are broad in scope.

3.6.1.2 NDI Standardization. The contractor process specification shall reflect procedures, acceptance criteria and records requirements to ensure adequate quality assurance measures are being enforced to keep the NDI process in control. Basic process, equipment, materials, and technique variables, as applicable, shall be monitored to ensure adequate control of the inspection process.

3.6.1.3 Approval. Contractor process specifications shall be submitted to the procuring activity for approval by appropriately certified personnel prior to their implementation.

3.6.2 NDI procedures. NDI procedures shall be provided for inspection of each part requiring inspection except when special procedures 3.6.2.2 or general procedures 3.6.2.1 are used. These procedures shall be in accordance with the requirements on the component drawing, or other engineering requirements, and shall contain, as a minimum, the information listed below:

a. Specific part of drawing reference.

b. Surface finish and part preparation, as applicable.

c. Manufacture and model number of all instrumentation to be used, indicating optional equivalents, if desired.

d. Fixturing requirements, as applicable.

e. Manufacturer and identification of required inspection materials.

f. Reference to contractor process specification procedure, if applicable.

g. Calibration/standardization procedure and reference standard identity as applicable.

h. Identification of areas to be inspected, detailed steps and level of inspector qualification required, and acceptable defect criteria, including location and most critical orientation (based upon primary stress condition and direction) or equivalent drawing or specification reference for these criteria.

i. Identifiable precautions in use of the inspection procedure.

j. Indicate applicable defect classification (critical, major, minor) or test paragraph.

3.6.2.1 General NDI procedures. General procedures are acceptable for common product forms, such as plate, bar stock, fasteners and tubular products.

3.6.2.2 Special NDI procedures. Special procedures to inspect designated components may be used to supplement process specifications. A contractor may elect to incorporate all processing criteria into each NDI procedure in lieu of generating process specifications.

3.7. Implementation of NDI procedures.

3.7.1 Personnel. The contractor shall have available records of certification for personnel conducting and interpreting nondestructive inspection in accordance with the applicable sections of MIL-STD-410.

3.7.2 NDI reports. The contractor's NDI reports and data records shall be kept on file pending disposition instructions from the procuring activity. Reports shall be signed or stamp identified by an authorized representative of the inspection facility.

3.7.3 Equipment and materials. The equipment and materials used for inspection shall be in accordance with the applicable inspection procedure. A list of equipment and materials shall be provided for Government review and approval. Specified equipment shall be within calibration interval to ensure that it is fully operational when used to conduct inspections.

3.7.4 Removal of Discontinuities. Whenever materials or components are subjected to further manufacturing for removal of discontinuities, they shall be subjected to reinspection. Removal of discontinuities shall be performed in a manner as not to enduce any notches or stress concentration in the part. Blending or material removal operations shall be compatible with the inspection technique and process used i.e. surface finish and contour requirements. The reinspection shall be conducted using the previous procedure. If it is necessary to use a different procedure for reinspection, an addendum to the original procedure shall be prepared, reviewed and approved in the normal cycle. The addendum shall detail the new procedure and the conditions for its use.

3.7.5 Inspection scheduling.

3.7.5.1 Receiving inspections. Incoming materials, parts or assemblies must meet the applicable engineering requirements.

3.7.5.2 Manufacturing and assembly. Inspection shall be performed as necessary during manufacture and assembly of components to ensure acceptable final parts or assemblies.

a. When processing operations are involved which may adversely affect the quality of material or part, such as heat treating, forging, or cold forging, NDI shall be performed subsequent to such operations.

b. When processing operations are involved which may interfere with the kind(s) of inspection to be used, inspection shall be performed prior to such operations.

3.8 Data and documentation. Requirements expressed or implied herein concerning preparation, submittal, approval, availability, retention, or delivery of data or documentation shall be applicable unless otherwise noted in the contract.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for NDI. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified in the NDI program. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements unless disapproved by the Government.

5. PACKAGING This section is not applicable to this specification.

6. NOTES

6.1 Intended use. To provide requirements and procedures which when tailored to individual weapon systems and equipment will enhance systems safety and reduce operating and support costs.

6.2 Applicability. This specification shall apply to all phases of the weapons systems life cycle, whether the life cycle follows the traditional process which includes conceptual, demonstration and validation, full scale development, production, deployment and disposal or the streamlined process consisting of proof of principle, development proveout, production and deployment and disposal. This specification shall apply to both original and replacement structural and propulsion components of weapons systems.

6.3 Subject term (key word) listing.

Nondestructive testing
Nondestructive inspection
Weapon systems
Program requirements
Life cycle guide

Custodian:
Army - MR

Review activities:
Army - AR, EA, AV, AL, MI, AT

Preparing activity:
Army - MR

Project No. NDTI-A050

(KBWP# ID-5504A/DISK 0063B. FOR MTL USE ONLY)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-P-46195(MR)	PROGRAM REQUIREMENTS, NONDESTRUCTIVE INSPECTION, FOR WEAPONS SYSTEMS, PARTS AND MATERIALS

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* — Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* — Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* — Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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