

# AMERICAN NATIONAL STANDARD

## *Guide to Inspection Planning*



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## *Guide to Inspection Planning*

*[Reaffirmation of ANSI/ASQC E2-1984]*

*Prepared by  
American Society for Quality Control  
Energy Division Standards Committee*

*An American National Standard Approved on January 12, 1996*

*Guide to Inspection Planning* describes the significant elements that should be considered in the development of inspection activities. The standard is intended to provide generic guidelines for a product/process inspection system.

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ASQC Mission: To facilitate continuous improvement and increase customer satisfaction by identifying, communicating, and promoting the use of quality principles, concepts, and technologies; and thereby be recognized throughout the world as the leading authority on, and champion for, quality.

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# Contents

	Page
1.0 Scope .....	1
2.0 Applicability .....	1
3.0 Definitions .....	1
4.0 Determination of Organizational Responsibilities and Information Sources as Bases of Inspection Planning ..	1
4.1 Responsibilities and Interface .....	1
4.2 Information Accessibility .....	2
5.0 Planning for Inspection Resources .....	2
5.1 Files and Records .....	2
5.2 Inspection Facilities .....	2
5.3 Inspection Personnel .....	2
5.4 Inspection Procedures .....	3
5.5 Preplanning Considerations .....	3
5.6 Scheduling and Revising Inspection Plans .....	3
6.0 Contents of Inspection Plans .....	3
6.1 Identification .....	4
6.2 Inspection Conditions .....	4
6.3 Characteristics .....	4
6.4 Acceptance Criteria .....	4
6.5 Inspection Methods .....	4
6.6 Extent of Inspection .....	5
6.7 Witness and Hold Points .....	5
6.8 Tests .....	5
6.9 Special Processes .....	5
6.10 Surveillance Inspection .....	5
6.11 Reporting Results .....	5
6.12 Inspection Release .....	6
7.0 Other Related Functions .....	6

## Foreword

(This Foreword is not part of the American National Standard ANSI/ASQC E2-1996, *Guide to Inspection Planning*.)

This standard was developed to provide guidance to industrial organizations in planning for and applying inspection to construction, manufacturing, operating, or service functions.

The standard is presented in a typical project time sequence, giving the organizational basics, project inspection planning elements, and then details of planning for direct inspection. It is presented as guidance, to be utilized as the applying organizations determine to be most appropriate. As such, it is not directly applicable to individual products or industries, but must be tailored to each specific case. The primary objective of the standard is to assist in making the inspection planning process most efficient and thus contribute to better quality of items/services provided and to better productivity.

ANSI/ASQC E2-1996 is a reaffirmation of ANSI/ASQC E2-1984. The Energy Division Standards Committee of ASQC included the following personnel during preparation of the 1984 version of this standard:

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**Suggestions for improvement of this standard will be welcome. They should be sent to the standard's sponsor, American Society for Quality Control, c/o Standards Administrator, 611 East Wisconsin Avenue, Milwaukee, WI 53202.**

ANSI/ ASQC E2-1996

## Guide to Inspection Planning

### 1.0 SCOPE

This standard provides guidance for an inspection planning system, identifies elements of the inspection planning process, and includes a section which presents techniques for the preparation of inspection plans for specific tasks and projects.

### 2.0 APPLICABILITY

This standard describes methods of planning for the inspection of products and services. The inspection covered by this planning activity includes that performed at source of supply, during receiving, storage, in-process, and at completion of work. The methods and techniques for inspection planning described in this standard are applicable to manufacturing, construction/installation, and operational activities.

The extent to which individual elements of this standard are applied can best be determined by the user, consistent with the intended end use, complexity of the item(s) and activities inspected, and contractual requirements. Where elements are contained as standard policy in a company's quality assurance manual or related documents, they need not be repeated.

### 3.0 DEFINITIONS

**inspection planning:** The function of evaluating and determining inspection requirements, preparing for inspection, and defining methods and means, including facilities, equipment, personnel, procedures, and plans, for fulfilling those requirements.

**inspection plan:** A document identifying methods and sequence for inspection including frequency of inspection, characteristics to be inspected, data to be recorded, tools, facilities, and referencing or otherwise defining acceptance criteria. The plan identifies a system for identifying and disposing of inspected items and activities. The inspection plan may be referenced as an integral part of the process control plan.

**inspector:** A person who, through examination, measurement, or test, determines conformance of a product or service to preestablished requirements, and then

records or otherwise acts upon the decision of acceptance or rejection.

**NOTE:** The inspection performed by the inspector may be a verification of checks made by personnel who performed the work activities on products/services.

**surveillance inspection:** An overview of selected activities as they are being performed to ascertain and verify conformance to requirements, often with special emphasis on materials, processes, and processing parameters.

**witness point:** A notification point in a function or process sequence where notification of the inspector is required for his or her option of observing or visually examining a specific work operation or test. Work may proceed beyond a witness point with or without inspection action following notification to the inspection organization.

**hold point:** Hold points are mandatory verification points identified within the inspection plan beyond which work should not proceed until mandatory verification is performed, acceptance established, or written release granted by the inspector.

### 4.0 DETERMINATION OF ORGANIZATIONAL RESPONSIBILITIES AND INFORMATION SOURCES AS BASES OF INSPECTION PLANNING

This standard presents guidance on inspection planning, based upon the existence within the organization of appropriate management controls and resources, or a quality assurance program. Inspection planning provisions should be documented as part of the quality assurance program. These provisions may be included in a manual, in a procedure(s), or instruction(s), and should include assignment of inspection planning responsibilities.

#### 4.1 Responsibilities and Interfaces

Responsibility within the organization for the inspection planning activity should be established. As part of inspection planning, responsibility for inspection activities and functions of supporting and interfacing organizations should also be determined. Typically, supporting and interfacing organizations include manufacturing, engineering,

## ANSI/ ASQC E2-1996

purchasing, quality engineering, marketing/contracts, cooperating contractors, suppliers, customers, and field service organizations. Arrangements for coordination with other inspection groups or organizations who have interfacing inspection responsibilities should also be established.

#### 4.2 Information Accessibility

Project information, such as contracts, schedules, work orders, specifications, drawings, manuals, procedures, configuration of operating equipment, and purchase orders, should be available to personnel who plan for inspection of products and services. It is important that acceptance criteria be established and defined clearly in technical documents such as drawings, specifications, and work instructions. Requests for quotation and bid proposals may be obtained on a discretionary basis if they contain information useful to the inspection planning function.

### 5.0 PLANNING FOR INSPECTION RESOURCES

This section presents information and guidance on items and topics to review during the preplanning stage for inspection, including matters of personnel, facilities, equipment, systems, and procedures.

#### 5.1 Files and Records

Facilities and files for maintaining forms, tags, hard copy, and computer or microform records should be available. Capability for obtaining and maintaining relevant specifications, drawings, contracts, and other documents in readily accessible files should be established. Capability for inspection records storage and protection for established retention periods and retrieval from files should also be established.

There should be access to referenced documents such as standards that set forth acceptance criteria, texts on inspection sampling, and other pertinent documents including applicable codes.

#### 5.2 Inspection Facilities

Facilities and inspection equipment required for performing inspections should be determined and provided as necessary. Consider the following:

- a. Space and equipment (surface plates, tools, gages, etc.) for inspection, affording environmental conditions (i.e., lighting level, temperature/humidity control, and cleanliness level) consistent with handling and inspection needs of products/services
- b. Facilities for receiving and handling of items being inspected (shelving, storage areas)
- c. Facilities for taking verification samples and for obtaining test results to validate significant characteristics
- d. Facilities for maintenance of archive samples where critical materials are involved
- e. Physical inspection systems and equipment for performing inspection and testing, including dimensional, electrical, mechanical, pneumatic, nondestructive examination (NDE), and destructive examination (DE)
- f. Facilities or alternate provisions for calibration of measuring equipment
- g. Physical inspection standards for:
  - Demonstration of acceptance criteria
  - Equipment calibration
- h. Computational/recording equipment for tallying and entering numerical or other pertinent information
- i. Equipment for performing special inspections for repaired or off-standard process items
- j. Equipment for performing inspection in the shop or in the field on items fabricated, shipped, stored, installed, or operating
- k. Inspection supplies
- l. Stamps, tags, or other devices for direct marking of inspection status of items inspected
- m. Controlled access space for storage of quarantined items

#### 5.3 Inspection Personnel

The inspection planning system should consider and provide for availability of inspectors with capability to perform the types of inspections scheduled. Typically, broad-base capabilities for dimensional, optical, nondestructive, and destructive evaluation and testing provide greatest versatility.

Indoctrination and training in the specifics of job technology, especially on the inspection methods, requirements, and acceptance standards, should be provided. On-the-job training under close supervision of senior inspectors or supervisors is particularly useful in the inspector's acquisition of training and experience. Inspection personnel should be qualified and, where required, personnel certifications should be obtained and appropriate documentary evidence maintained.

#### 5.4 Inspection Procedures

Inspectors may be provided detailed guidelines, checklists, instructions, or procedures when necessary to supplement the drawings, specifications, and other applicable documents.

#### 5.5 Preplanning Considerations

For overall plan, as appropriate:

- a. Determine scope of tasks or project(s).
- b. Review functions of item(s), uses, and expected lifetime, to determine significant characteristics. (Review qualification data for items as one source of information on significant characteristics.)
- c. Consider manufacturing methods and process repeatability in developing an inspection plan.
- d. Select physical comparison standards or visual aids to display acceptance criteria when visual interpretations may be difficult to render consistently.
- e. Obtain definitive clarification from the responsible organization when specification or drawing characteristics are open to interpretation.
- f. Discuss product/service needs with customers.
- g. Review inspection practices for similar products/services by other organizations. (Consider making visits to review pertinent details of the inspections.)
- h. Consult with suppliers of inspection equipment to determine most efficient means of meeting qualification and calibration requirements of purchased equipment.
- i. Evaluate information gained by inspection (for product/service improvement, characterization of items, feedback to designer, reliability analyses, forwarding of results to customer, and problem solving/corrective actions).
- j. Determine the need for inspector training, prior to initiation of the plan, if possible, especially for unique or nonstandard inspection techniques.
- k. Confer with interfacing organizations to plan logistics and flow of items for inspection. Determine need for source, receiving, in-process, and final inspection.
- l. Develop inspection methods for items concurrently with prototype or preproduction stage. If appropriate, develop physical standards or visual aids for use during production inspection.

- m. Review procurement, manufacturing, construction, or maintenance schedule or plan to determine optimum points for the integration of pertinent inspection. Consider first-piece inspection (to detect deficiencies early in cycle), witness points, or hold points.
- n. Plan for application of surveillance inspection to in-process operations and quality assurance systems on a periodic, rotational, statistical, or random basis, as needed.
- o. Plan for reinspection of critical items or characteristics on a sampling basis to assess inspection repeatability.
- p. Determine requirements for inspection of items in storage, including their preservation, need for maintenance, shelf life, and maintenance of identification/traceability.
- q. Make arrangements for identification and control of nonconforming items (for example, segregation where appropriate).
- r. Provide for verification of the acceptability of items for use or installation, including review of appropriate data package or documentation.
- s. Determine final inspection acceptance requirements to be performed prior to shipment or use.

#### 5.6 Scheduling and Revising Inspection Plans

The inspection planning process should include a mechanism for determining the need for inspection plans and for initiating the inspection plans. These should be developed in conjunction with the manufacturing/construction operation process schedules. Also, as appropriate:

- a. Develop a schedule for preparation of specific inspection plans for inspections to be performed (at selected points in process, at specified times during a project, and at times or cycles in operations).
- b. Establish requirements for control of inspection plans and changes thereto, including review and approval requirements, distribution, and provision for updating (for example, for design changes and for improved inspection methods).
- c. Provide for reinspection of customer-returned or nonconforming items as a means of evaluating the effectiveness of the inspection system. Initiate and incorporate the necessary revisions to inspection plans.

#### 6.0 CONTENTS OF INSPECTION PLANS

This section presents information and guidance on preparation of inspection plans for specific tasks and projects. Note



## ANSI/ ASQC E2-1996

that the complexity of the item(s) being inspected may require the individual who is preparing the inspection plan to work in close coordination with the designer to determine the significant characteristics to be inspected. The following are various elements that should be used within the inspection plan.

### 6.1 Identification

Identify what is to be inspected in a manner to provide for traceability between the item, item identity, item manufacture/service operation, and inspection records.

- Name, part number, purchase order number, serial number, model number, lot number, heat number
- Material, assembly, subassembly, component identifier
- Size, weight, color
- Process, operation, quantity/batch characteristics
- Mating parts, dimensions, etc.
- Quality records or certifications
- Inspector identification, date, and data requirements

Identify primary references of technical requirements for items and services such as drawings, specifications, and procurement documents. Include the specific document number and revision number or date of the document. Provision should be made for the inspector to enter the revision number or date on the inspection record. In addition, supplemental reference documents may include

- Inspection criteria documents (required codes and standards)
- Inspection procedures and instructions
- Manufacturing and work instructions and procedures
- Fabrication/flow schematics
- Operating/instruction manuals
- Configuration information

### 6.2 Inspection Conditions

Indicate in the inspection plan inspection sequence and timing, for example, concurrent with tooling change, upon receipt, after completion of an intermediate step, prior to shipping, or upon transfer to a new location. If timing is critical, as when inspection is a "hold point," this should be identified (see 6.7).

Identify special inspection conditions, such as proper lighting level and magnification limits for visual inspection,

conditions of cleanliness, surface preparation, and temperature for the work piece.

Identify requirements for specially qualified personnel.

Identify needed environmental conditions (temperature, humidity, cleanliness).

Identify physical limitations (clearances, access considerations) and any special handling requirements.

State requirements regarding removal and replacement of packing, coating, or other protective material.

List requirements for locking out or tagging items for personnel safety or to maintain the system/item in the accepted conditions.

### 6.3 Characteristics

Identify characteristics to be inspected. Where appropriate characteristics may be classified into categories, i.e., critical, major, and minor. If conditional acceptance is possible (due to tolerance allowance or other variable parameters), so identify.

Identify, as necessary, the number and location of data points and information to be recorded for each characteristic to be inspected.

### 6.4 Acceptance Criteria

Provide sufficient information, directly or by reference, to enable the inspector to determine if the item or activity is conforming or nonconforming. Acceptance criteria may include dimensional tolerances, instrument readings, visual appearance, results of destructive testing on representative samples, and functional requirements. Physical standards that represent limits of acceptance are particularly useful in arriving at consistent boundaries of acceptance and common understanding by interfacing groups (inspector, producer, designer, and customer).

### 6.5 Inspection Methods

Define methods for performing inspection such as work piece set-up directions, observation techniques, techniques for obtaining item attribute information, and methods for checking fit or function.

Specify inspection equipment requirements (gages, meters, tools), including range accuracy, and calibration requirements, as applicable.

Methods for surveillance inspection of processes are useful; for example, ways to monitor special process parameters.

## ANSI/ ASQC E2-1996

A brief descriptive paragraph on items to be inspected may be appropriate to provide the inspector with appreciation for the significant characteristics.

The plan should indicate action to be taken for items found not to meet acceptance criteria (physical separation, have items corrected, identify items as nonconforming, as appropriate).

### 6.6 Extent of Inspection

Indicate how much inspection to apply to items:

- a. None (process controls are adequate)
- b. Sampling (stratified samples inspected intermittently verify continuing validity of initially established quality)
- c. Complete inspection (all items inspected where processes are variable or for final inspection of critical characteristics)
- d. A combination of the above (all items inspected for certain characteristics, but only selected sample items examined for other characteristics, based on end-item requirements and a known degree of process control)

Sampling plans, when appropriate, should be specified in sufficient detail to provide requirements for sample selection and disposition of the lot based on inspection results.

Sampling plans should be selected using the applicable document, or developed based on the criticality of the product, quantities involved, the risks involved, contractual requirements, and other similar factors. There are a number of valid bases for statistical sampling which may be used in developing a sampling plan.

### 6.7 Witness and Hold Points

Delineate witness points and hold points consistent with manufacturing/construction/operation process flow sheets and identify the organization which may perform the inspection. Include steps in process such as completion of subassemblies, tests, special process performance, points in process where critical parameters are to be measured and maintained, and points where further processing may render important characteristics uninspectable.

Requirements for review during hold points by customer and other designated representatives should be determined by review of contracts and technical specifications and included in the inspection plan.

### 6.8 Tests

Tests to be performed should be listed in the inspection plan with reference to the test procedure. Testing frequency and stage in processing where item to be tested is selected should also be considered.

### 6.9 Special Processes

Identify requirements for the inspection of special processes, such as cleaning, bending, welding, heat treating, and nondestructive examination. Identify requirements for inspector qualification and certification, if applicable.

Identify unique instructions and/or procedures of the special process clearly, including unusual conditions or configurations, sampling or testing requirements, and information to be recorded.

### 6.10 Surveillance Inspection

Surveillance inspection may be performed during fabrication, construction, storage, or in-service to verify adequacy of a supplier's inspection program or to determine that the producer's quality verification activities are adequate.

The inspection plan may include a section defining techniques for surveillance inspection, and describing observation to be made of general conditions, including housekeeping/cleanliness, identification of parts and components, exclusion of foreign materials, and notation of inspection status of items. When special processes are in use, spot reviews should be made to assess general conditions and operations, including checks on qualification of equipment, personnel, process, and procedure.

Methods for verification of inspection results of characteristics, by alternate means, may be included (for example, rough check of steel classification by magnetic property; go-no go check of actual dimension).

Methods for obtaining spot samples for validation by alternate nondestructive or destructive evaluation may be included.

### 6.11 Reporting Results

Identify either an appropriate inspection reporting form or the results to be documented (identification, inspection data, identity of inspector, and date of inspection). Inspection records should be identifiable to batch, lot, serial

## ANSI/ ASQC E2-1996

number, or work order number. When data is to be taken, define the number of data points and specify the appropriate format for recording the data.

The Inspection Plan should provide for

—Obtaining and comparing inspection information, data, and results to acceptance criteria. A decision should be reached with each inspection identifying whether or not compliance with acceptance criteria has been achieved. This acceptance/rejection decision should be recorded, dated, signed or stamped, and made available to interacting groups

—Obtaining written disposition for authorized organizations (for example, a material review board) for release of nonconforming items and services

—Including in reports as-built information, i.e., required actual measurements, and providing them to the organization responsible for configuration control

—Provide inspection data, including descriptions of any defective items or services, on a timely basis to responsible organizations as feedback to be used for trend analysis, design, or process improvement

### 6.12 Inspection Release

Provide for inspection release of items or services at significant stages. Controlled access storage should be provided

for important items when determined necessary. The inspection release should ensure that all criteria required for release have been met, i.e., what items of nonconformance have been dispositioned acceptable, what nonstandard processes have been used for repair, if any, and that reinspection has been applied. For items to be shipped or services provided under contract, a certificate of conformance (with appropriate objective evidence) is often used as a method for documenting release.

## 7.0 OTHER RELATED FUNCTIONS

Other inspection planning activities should be considered as inspection of products/service progresses, and performed as necessary. Examples include

- a. Prepared and provide summarized data to management groups for evaluation to enable efforts at improvement, such as trend analyses, reliability analyses, and problem solving/corrective actions.
- b. Provide inspection data, including descriptions of any defective items or services, to responsible design organizations as feedback.
- c. Provide status of acceptance of products and services to interested groups, such as plant managers or controllers groups, for invoicing actions.



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