DATA ITEM DESCRIPTION
Title: MEASUREMENT SYSTEM EVALUATION (MSE) – MEASUREMENT AND INSPECTION EQUIPMENT SYSTEM DESIGN DOCUMENTATION FOR ACCEPTANCE OF PRODUCT

Number: DI-QCIC-81960 **Approval Date**: 25 February 2014
ASMC Number: 9461 **Limitation**: N/A
DTIC Applicable: N/A **GIDEP Applicable**: No
Office of Primary Responsibility: (AR) , RDAR-EIQ-SE
Applicable Forms: N/A

Use/relationship: The Measurement and Inspection Equipment System Design documentation for Acceptance of Product describes the Acceptance Inspection Equipment (AIE), Automated AIE (AAIE), and various measurement systems, used to meet the inspection and test requirements to deliver units and other end products that conform to contract, specification, QAP and drawing requirements. This documentation is used to evaluate the acceptability of these designs to meet contract requirements.

a. This Data Item Description (DID) contains the format and content preparation instructions for the data product generated by the specific requirement delineated in the contract.

b. This DID is applicable to all AIE as required by the contract.

Requirements:

1. Reference Documents. The applicable documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions, shall be as cited in contract documentation.

2. Format. Contractor's format is acceptable.

3. Content. An AIE package shall include the following (as applicable).

3.1 Cover Sheet. Cover sheet information includes the following:

a. Prime contractor name, address, and contact information.
b. Contract number.
c. Nomenclature of item(s) being produced under contract.
d. Applicable drawing(s), specifications and Quality Assurance Provisions (QAPs).
e. Date and revision of "New" or "Revised" documentation.
f. Sub-component or assembly (if applicable).
g. Subcontractor(s) name, address, and contact information (if applicable).

3.2 Measuring and Inspection Equipment System Design Documentation. Measuring and inspection equipment system design documentation covers a variety of measurement systems and equipment used to evaluate acceptability of units to meet requirements. See ISO 9000 paragraph 3.8.2, Inspection and 3.10.4, Measuring Equipment.

3.3 Master List / Matrix. A detailed Master List or Matrix cross references each characteristic and its inspection requirement from the applicable drawings, specifications and QAPs with the proposed inspection methods and equipment. The Master List or Matrix information includes the following:

a. Drawing, specification or QAP number with revision and date of item being inspected.
b. Amendments, Engineering Change Proposals (ECPs), Notices of Revision (NORs), etc.
c. Specification or QAP paragraph number.
d. Drawing, specification, or QAP characteristic letter/number, description, and inspection requirement.

e. Inspection method with AIE identification with description, revision, and date.
f. Clearly indicate any revisions from previous submission(s).

3.4 Go-No Go/Functional Gages. Gage information includes the following:

a. Gage drawing number (design identification) with revision and date.
b. Drawings showing gage dimensions with tolerances.
c. Drawings showing gage material with surface finish and hardness of contacting gage elements.
d. Associated inspection procedures and theory of operation (as required, see ISO 10012).

3.5 Standard Measurement Equipment (SME). SME information includes the following:

a. Manufacturer, model, resolution, and accuracy.
b. Associated inspection procedures and theory of operation (as required, see ISO 10012).

3.6 Special Inspection Equipment/Methods. It includes Coordinate Measuring Machines (CMM), Tool Control (TC), Non-Destructive Testing (NDT), Automated Acceptance Inspection Equipment (AAIE), Destructive, Environmental, and Functional Test Equipment. It also includes inspection equipment that is not commercially available along with the corresponding design drawings.

a. **Coordinate Measuring Machine (CMM)**. CMM information includes the following per ASME B89.4.10360.2-2008:

i. Establishment of the geometry (Datums) and inspection process of the desired characteristic by the CMM. Include the number and location of probe hits to establish geometry (Datums) and any axis necessary to adequately inspect the feature.
ii. Environmental conditions and limits which may influence measurements.
iii. Operating procedures including machine start/warm up cycles, probing system qualification, probe cleaning, and probe calibrations.
iv. Periodic reverification tests in accordance with the user's specification and manufacturer's procedures including repeatability of point coordinates and length measurement and repeatability.
v. Interim checks between periodic reverifications.
vi. Procedure for checking the CMM immediately after a significant event which could impact CMM performance.

b. **Tool Control (TC)**. Tool Control information includes the following:

i. Measurements of form tools (punches, dies, molds, etc.) and correlation data between tool dimension and component dimension.
ii. Inspection frequency and gages used to measure the form tooling.
iii. Process control parameters that affect the component dimension.
iv. Procedures for tool control inspection including out of tolerance tool control dimension procedures, corrective action plans, and segregation of product since last successful inspection.

c. **Non-Destructive Testing (NDT)**. NDT information includes the following:

i. Written procedures for the qualification and certification of NDT personnel and the certification records for each inspector, as described in NAS410 (NAS Certification & Qualification of NDT Personnel), ANSI/ASNT-CP-189 (ASNT Standard for Qualification and Certification of NDT Personnel), or SNT-TC-1A (Recommended

Practice for Personnel Qualification and Certification in NDT), and additional procedures identified by the Government.

ii. Records for other certification standards shall identify the applicable standard and confirm the levels of qualification of individuals responsible for acceptance of product to be consistent with those defined in the standard.

iii. The design documentation, specific application techniques, and operating procedures in accordance with ASTM E 543 (Standard Specification for Agencies Performing Nondestructive Testing) and the applicable nationally recognized standard practice(s) specific to the NDT method(s) employed on the contract, such as ASTM E-1742 (Standard Practice for Radiographic Examination) and SAE-AMS-STD-2154 (Inspection, Ultrasonic, Wrought Metals, Process For).

iv. Documentation on application techniques shall identify the applicable standard(s) utilized.

d. **Automated Acceptance Inspection Equipment (AAIE) & Complex Designs**. For AIE designs that are complex in nature, (e.g., open set-up, computer controlled, numerically controlled, multistation, and acceptance inspection equipment which is part of an integrated production and assembly system) the following information is to be provided:

i. Concept designs (MIL-A-70625A, p. 3, paragraph 3.2.1) includes:
   (1) Sketches of the inspecting elements.
   (2) Theory of operation including mechanical, electrical, and unique software operating conditions with associated logic flow diagrams.
   (3) Description of the calibration and verification programs and standards.
   (4) Description of all fail-safe measures that lead to rejection of Unit Under Test (UUT).
   (5) A proposed test plan to qualify the accuracy of inspection and correctness of accept or reject decisions and resultant actions.
   (6) Manufacturer, model, resolution, and accuracy of any commercial device to be incorporated in the design.
   (7) A method for verifying the integrity of the code (e.g., checksum or cyclic redundancy check).

ii. Detailed proposed designs (MIL-A-70625A, p. 4, paragraph 3.2.2) include:

   a. After concept approval and before any fabrication:
      (1) Drawings of the inspecting elements.
      (2) Proposed system operation including mechanical, electrical, and unique software operating conditions with associated logic flow diagrams. Drawings of the calibration or verification standards.
      (3) The computer test program to include software version, software design parameters, and flow charts showing acceptance/rejection settings and computer generated test stimuli (as differentiated from computer controlled standard test equipment stimuli).
      (4) Schematic or block diagram of test and measuring circuits where applicable.
      (5) Layout or block diagram showing overall equipment arrangement and interconnection, including the Unit Under Test (UUT).
      (6) Details of adapters, cables, holding fixtures and like items as applicable.

   b. Before performing the test to qualify the AIE:
      (1) Setup, calibration, operation, and verification instructions.
      (2) The final test plan.
      (3) Computer test program, acceptance/rejection settings and a flow diagram.

(4) Detailed operating instructions indicating application of the AIE and the acceptance/rejection settings.
(5) The calibration program for each item of computer controlled test equipment and a sample printout of an actual test and calibration.
(6) A printout of the work instructions which are displayed for the operator.

iii. Final designs (MIL-A-70625A, p. 6, paragraph 3.2.5) include:

(1) Results of the test including data generated, printout of test results (when normally generated), unique software test results, and calibration results.
(2) Design depicting the equipment as it was tested.
(3) Setup, calibration, operation, and verification procedures
(4) Calibration and verification records.

e. **Destructive, Environmental, and Functional Test Equipment**. For Destructive, Environmental, and Functional (DEF) test equipment, the following information is to be provided:

i. Proposed AIE designs include:
(1) Theory of operation.
(2) Detailed drawings or sketches of the inspecting and testing elements and sufficient detail for supporting elements to facilitate evaluation for adequacy.
(3) Manufacturer, model, resolution, and accuracy of any commercial device to be incorporated in the design along with any modifications in design or use.
(4) Description of the calibration and verification programs and standards.
(5) A proposed test plan to qualify the accuracy of inspection and correctness of accept or reject decisions and resultant actions (as required).
(6) Setup, calibration, operation, and verification procedures and parameters.
(7) Settings, test conditions, calculations, and verification.
(8) Calibration and verification records.

ii. When DEF test equipment consists of AAIE or complex Designs, AIE design submissions shall include the requirements of paragraph 3.6.d above.

f. **Measurement Systems Analysis (MSA)**. MSA is any of a number of specialized methods useful for studying a measurement system and its properties (ASTM E2782, paragraph 3.1.7).

There are several basic properties of measurement systems that are widely recognized among practitioners. These are repeatability, reproducibility, linearity, bias, stability, consistency, and resolution (ASTM E2782, paragraph 5.4). An MSA is to include these properties, as applicable.

End of DI-QCIC-81960