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52.246-4018

**MEASUREMENT SYSTEM EVALUATION**

**APR 2014**

(a) **Definitions.** This paragraph defines specific terms utilized throughout the rest of the clause and in the accompanying Contract Data Requirements List (CDRL) and Data Item Description (DID) (DI-QCIC-81960). This aids in clarifying the MSE requirements to Government and contractor personnel.

- (1) **Acceptance Inspection Equipment (AIE).** All equipment (includes AAIE defined below), special and standard, including dimensional gages, measuring equipment, test fixtures, electronic and physical test equipment, and other test equipment used for examination and test of a product to determine conformance to the Technical Data Package (TDP) which may include drawings and specifications (e.g., Detail, Performance, Weapon specifications, and QAPs).
- (2) **Automated Acceptance Inspection Equipment (AAIE).** AIE in which the inspection and acceptance determination of the product is performed, in whole or in part, in an automatic manner.
- (3) **Contractor Inspection Equipment.** Government-approved equipment utilized by the contractor to perform examination and tests to assure conformance to contract requirements.
- (4) **Commercial Inspection Equipment.** Industry-developed inspection equipment of universal application, without limitations to a specific part or item, which is advertised or cataloged as available to the trade or to the public on an unrestricted basis at an established price. Examples follow:
  - (i) **Standard Test Equipment.** Multiusage equipment that is specific to a function rather than to an item. It includes such items as hardness testers, tensile strength testers, meters, weighing devices, standard gear testers, ohmmeters, voltmeters, and oscilloscopes.
  - (ii) **Standard Measuring Equipment (SME).** Multipurpose equipment and standards used for performing measurements. It includes such items as micrometers, rulers, tapes, height gages, and protractors, etc. Standards include visual inspection equipment such as scratch and dig standards, surface finish comparator, color standards (FED-STD-595), etc.
- (5) **Nondestructive Testing.** The development and application of technical methods to examine materials or components in ways that do not impair future usefulness and serviceability in order to detect, locate, measure and evaluate flaws; to assess integrity, properties and composition; and to measure geometrical characteristics. NDT includes Radiography/Radioscopic, Ultrasonic, Eddy Current, Magnetic Particle, and Liquid Penetrant.
- (6) **Measurement System Analysis (MSA).** Per ASTM E2782 (Standard Guide for MSA), paragraph 3.1.7, MSA is any of a number of specialized methods useful for studying a measurement system and its properties.

(b) **Scope.** This clause establishes requirements for design, supply, performance, and maintenance of AIE used for product inspection and acceptance. In addition, this clause establishes requirements for the preparation, submission, and approval of AIE documentation.

(c) **AIE.** The contractor shall provide all AIE necessary to ensure conformance of components and end-items to contract requirements. AIE shall include inspection, measuring, and test equipment whether Government furnished or contractor furnished (including commercially acquired) along with the necessary specifications and procedures for their use (see ISO 10012, paragraph 6.2.1). The AIE shall not create or conceal defects on the product being inspected. All AIE documentation shall contain sufficient information to permit evaluation of the AIE's ability to test, verify, and/or measure the applicable characteristics or parameters (see DI-QCIC-81960).

(d) **AIE Designs & Government Furnished Gages.** AIE designs are of two types – Government designs (see d.1) and contractor designs (see d.2). When applicable, Government designs or Government furnished gages are

designated in the TDP/contract; responsibility for all other AIE is assigned to the contractor. The designs, associated inspection procedures, and theory of operation shall have the level of detail to demonstrate capability of the proposed AIE to perform the required inspection.

- (1) **Government AIE Designs.** Government AIE designs may consist of detailed drawings necessary for the fabrication and use of the AIE. Unless otherwise specified, the contractor may submit alternate or modified contractor designs of Government AIE designs.
- (2) **Contractor AIE Designs.** Contractor AIE design drawings shall meet the requirements of ASME Y14.100, ASME Y14.5 and ASME Y14.43 and may include commercial inspection equipment. [“Commercial inspection equipment” is defined as shown in paragraph a.4 above. It shall be fully described by catalog listings or other means which provide sufficient information to permit identification and evaluation by the Government and may include illustrations and engineering data.] Designs shall be submitted for any special fixture(s) to be used. Unless otherwise specified, Gage Tolerancing Policy shall be in accordance with ASME Y14.43, “Absolute Tolerancing (Pessimistic Tolerancing).”
- (3) **Visual Inspection.** Visual inspection standards used for the acceptance/rejection of product shall be submitted for approval.

(e) **AIE Package Submittals.** The contractor shall prepare the AIE package submittal in accordance with DI-QCIC-81960 in the applicable Contract Data Requirements List (CDRL – DD Form 1423). In addition, the contractor shall adhere to the following requirements:

- (1) **Designs for Approval.** Contractor designs and/or the submission for the use of Government designs shall be approved by the Government. Partial submission of AIE designs is permissible in order to expedite the approval process; however, the response date for design review will be based on the date of the final complete submission of designs.
- (2) **Correspondence in English.** The contractor shall ensure all AIE correspondence and documentation are submitted in English.
- (3) **Units of Measurement.** The units of measurement within the AIE package submittal shall be consistent with the requirements of the Technical Data Package (TDP).
- (4) **AIE Flow Down.** The contractor shall flow down AIE requirements to sub-contractors at any tier who are performing acceptance inspections.

(f) **Characteristics for Inspection.** AIE documentation for Critical, Special, and Major characteristic inspections shall be submitted to the Government for approval in accordance with (IAW) the CDRL (DI-QCIC-81960). AIE for Minor characteristic inspections shall be submitted to the Government for approval IAW CDRL (DI-QCIC-81960) and as required below:

- (1)  Listed Minor (characteristics displayed on specifications and/or drawings)
- (2)  Government selected list (as attached or as provided herein)
- (3)  Not submitted

(g) **Automated Acceptance Inspection Equipment.** The AAIE shall accept only conforming material. All characteristics requiring AAIE per the TDP shall utilize inspection equipment with a minimum demonstrated reliability of 99.8% at a 90% confidence level to detect non-conforming material unless otherwise specified below.

- (1) Reliability of \_\_\_\_\_% at a \_\_\_\_\_% Confidence Level for Critical/Special Characteristics
- (2) Reliability of \_\_\_\_\_% at a \_\_\_\_\_% Confidence Level for Major Characteristics
- (3) For inspection of major and minor characteristics where contractor utilizes AAIE when it is not required by the TDP, the AAIE package shall be submitted to the Government for approval. If the Minor characteristic is not listed in paragraph f.2 or not required for submittal in paragraph f.3, then the AAIE requirements (e.g., verification, calibration, prove-out, etc.) of the inspection shall still be performed.
- (4) All AAIE packages submitted to the Government for approval shall be in accordance with MIL-A-70625 (*Automated Acceptance Inspection Equipment Design, Testing and Approval of*). Furthermore, the contractor shall be responsible for producing the acceptance and rejection verification standards/masters representative of the characteristics the AAIE is designed to inspect. The verification standards and frequency of use require

Government approval prior to use. When verification standards are used for the VL-VII “sampling plan” per MIL-STD-1916 paragraph 4.4, verification standards and frequency of use shall require Government approval prior to use.

- (5) If the AAIE accepts a critical characteristic “reject” standard the contractor shall notify the Government and act in accordance with paragraph f of the Critical Characteristic Control Clause. In addition, if the AAIE accepts a major and/or minor characteristic “reject” standard the contractor shall act in accordance with paragraph 8.3 of ISO 10012 or paragraph 5.2.3 of ANSI/NCSL Z540.3.
- (6) All AAIE shall be required to pass a Government-approved Acceptance (Prove-Out) Test. The contractor shall conduct this test per the approved test plan and shall submit a test analysis report for approval. See applicable CDRL (DI-QCIC-81960). This test shall be performed at the contractor’s facilities whose manufacturing system has had the AAIE fully integrated and calibrated as per paragraph (j) of this clause. The contractor shall allow Government personnel access to this facility and unobstructed monitoring of this test.
- (7) The contractor shall notify the Government prior to a modification and/or relocation of the Government-approved AAIE. The modified AAIE designs shall be submitted for approval. The modified and/or relocated AAIE shall require submission of the acceptance test plan (prove-out) and results for review and approval prior to use. The modified and/or relocated AAIE shall be in accordance with paragraphs (g)(1) – (g)(6).

(h) **Measurement System Analysis (MSA).** The contractor is responsible to ensure all AIE is, at a minimum, stable, repeatable, and reproducible for all characteristics. Refer to ASTM E2782 and/or AIAG MSA for guidance. The contractor shall provide objective evidence, including the MSA assessment plan, associated data, and analysis, which demonstrates the AIE is, at a minimum, stable, repeatable, and reproducible for the following characteristics (MSA CDRL):

Specification	Paragraph No.	Drawing	Characteristic

Approval of submitted MSA(s) must be granted before the corresponding AIE can be used or continue to be used for acceptance of product. If at any time following approval of the AIE and MSA the AIE is disapproved, then the MSA shall be disapproved. After the resubmitted AIE is approved, the MSA shall be conducted on the approved AIE and resubmitted for approval.

(i) **Robust AIE System.** The contractor shall ensure the AIE and its use is not negatively affected by any manufacturing/inspection environmental stimuli including, but not limited to production rate, noise, temperature, humidity, and vibration.

(j) **AIE Calibration and Verification.** The calibration system shall be in accordance with ISO 10012 or ANSI/NCSL Z540.3. All AIE shall be subjected to scheduled calibration intervals to ensure that the equipment will accept only conforming product and reject all non-conforming product for the duration of the approved calibration period. AIE shall be subjected to periodic verification to ensure that the equipment will continue to accept and reject product with the same consistency as it did at the time of its previous calibration.

(k) **Non-Destructive Testing (NDT).** Contractor shall submit detailed plans for qualifying and certifying NDT personnel and plans for qualification and ongoing use of NDT methods used for inspecting product. If re-qualification of NDT personnel and/or NDT methods is required, then the applicable plans shall be submitted.

- (1) Personnel performing NDT examinations shall be qualified and certified in accordance with the standard practices prescribed by NAS 410 (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 that may be identified by the Government. Acceptance of product using NDT shall be performed by personnel at a level of qualification consistent with that defined in the applicable standard.

(2) The NDT method(s) shall be applied in accordance with ASTM E 543 (Standard Specification for Agencies Performing Nondestructive Testing) and the current nationally recognized standard practices appropriate to the NDT method(s) employed, such as ASTM E-1742 (Standard Practice for Radiographic Examination) and SAE-AMS-STD-2154 (Inspection, Ultrasonic, Wrought Metals, Process For). Each application technique shall identify the standard(s) utilized. Non-destructive testing includes, but is not limited to, the following types of testing: Radiography/Radioscopic, Ultrasonic, Eddy Current, Magnetic Particle, and Liquid Penetrant.

(l) **Contractor Alternate Inspection Method(s), Modifications and/or Relocation of AIE (Non-Automated) After Government Approval.** If the contractor proposes an alternate inspection method and/or modifies the AIE design(s) affecting hardware, software, or procedures after Government approval the intended change(s) shall be submitted to and approved by the Government prior to implementation. If an AIE is relocated and the relocation risks the integrity of the inspection system, notify the Government to determine information needed to assess impact to AIE. See CDRL (DI-QCIC-81960).

(m) **Responsibility for AIE Package Submittal.** The contractor shall submit the AIE design documentation package within contractual timeframes per CDRL (DI-QCIC-81960). The Government will provide approval or disapproval within the timeframe specified in the CDRL. Disapproval of the AIE package will require re-submittal and subsequent Government review in accordance with the CDRL requirements. The AIE package and any required prove-outs must be approved prior to First Article (FA) (if required) or production start-up if FA is not required.

(n) **Government's Right to Disapprove AIE.** The Government reserves the right to revoke approval of any AIE that is not satisfying the required acceptance criteria at any time during the performance of this contract. See CDRL (DI-QCIC-81960).

(o) **Navy Furnished Gages.** When gages are listed in paragraph o.9 below, the Navy Special Interface Gage (NSIG) Requirement paragraphs o.1 – o.8 shall be satisfied.

- (1) The NSIG(s) are provided for verification of selected interface dimensions and do not constitute sole acceptance criteria of production items or relieve the contractor of meeting all drawing/specification requirements under the contract.
- (2) The contractor is responsible for contacting the Naval Surface Warfare Center (NSWC), Corona Division at least 45 days prior to FAT (if required) or production, for the delivery of NSIG(s).
- (3) NSIG(s) will be forwarded to the contractor for joint use by the Government and the contractor. Government furnished NSIG(s) shall not be used by the contractor(s) or subcontractor(s) as in-process or working gage(s).
- (4) For production items that fail to be accepted by the applicable NSIG(s), an alternate inspection method may be submitted for approval.
- (5) The contractor may substitute contractor designed and built AIE for the NSIG(s) noted in paragraph (o.9) below. However, the designs require Government (Navy) approval and the contractor AIE hardware requires Government (Navy) certification. AIE designs shall be submitted in accordance with CDRL (DI-QCIC-81960).
- (6) The Government (Navy) shall not be responsible for discrepancies or delays in production items resulting through misuse, damage or excessive wear to the NSIG(s).
- (7) Calibration and repair of the NSIG(s) shall only be performed as authorized by the NSWC Corona Division. Repair is at no cost to the contractor unless repair is required due to damage to the gages resulting from contractor fault or negligence. Damaged, worn, or otherwise unserviceable NSIG(s) shall be brought to the immediate attention of the CAO and NSWC Corona Division. The contractor shall not make any adjustments, alterations or add permanent markings to NSIG(s) hardware unless specified by the NSIG operating instructions or authorized by the NSWC Corona Division.

(8) Within 45 calendar days after final acceptance of all production items, the NSIG(s) shall be shipped to NSWC Corona Division, ATTN: Receiving Officer, Bldg 575, Gage Laboratory, 1999 Fourth St., Norco, CA 92860-1915. The following shipping and marking specifications are applicable:

- (i) Shipping, MIL-STD-2073, "DOD Standard Practice for Military Packaging"
- (ii) Marking, MIL-STD-129, "Marking for Shipment and Storage".

(9) The following NSIG(s) shall be provided and are mandatory for use except as noted by paragraph (o.5) above.

<b>Drawing</b>	<b>Rev</b>	<b>Characteristic</b>	<b>NSIG No.</b>	<b>Qty</b>	<b>Dimensions</b>	<b>Weight</b>	<b>Value</b>

(End of clause – MSE)