

MILITARY SPECIFICATION

TEST EQUIPMENT (SIMPLIFIED) FOR INTERNAL COMBUSTION
ENGINES-REPROGRAMMABLE (STE/ICE-R) TEST SET

This specification is approved for use within the US Army Tank-Automotive Command, 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 covers the STE/ICE-R test set.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks 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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A

FSC 4910

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SPECIFICATIONS

MILITARY

- MIL-E-6051 - Electromagnetic Compatibility Requirements, Systems.
- MIL-1-45607 - Inspection Equipment, Acquisition, Maintenance and Disposition of.

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-130 - Identification Marking of US Military Property.
- MIL-STD-454 - General Requirements for Electronic Equipment.
- MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.
- MIL-STD-45662 - Calibration Systems Requirements.

2-1.2 Other Government documents, drawings, and publications . The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

DRAWINGS

ARMY

- 12259266 - VTM/Transducer Kit Assembly.
- 12259329 - STE/ICE-R Software Documentation.

QUALITY ENGINEERING PLANNING LIST (QEPL)

- QEPL 12259266 - Master List of Quality Assurance Requirements.

QUALITY ASSURANCE REQUIREMENTS (QAR)

- QAR 12259329 - Software Quality Assurance Requirement.
- QAR 12259265 - VTM Quality Assurance Requirement.

OTHER PUBLICATIONS

- TM 9-4910-571-12&P - Operator's and Organizational Maintenance Manual for Simplified Test Equipment for Internal Combustion Engines - Reprogrammable (STE/ICE-R).
- TM 9-4910-571-34&P - Direct and General Support Maintenance Manual for Simplified Test Equipment for Internal Combustion Engines - Reprogrammable (STE/ICE-R).

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| TB 9-4910-555-35 | - Calibration Procedure for Simplified Test Equipment for Internal Combustion Engines - Reprogrammable/STE/ICE-R). |
| CR 82-588-003 | - STE/ICE-R Design Guide for Vehicle Diagnostic Connector Assemblies. |

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

2.2 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.

3. REQUIREMENTS

3.1 First article. Unless otherwise specified (see 6.2), the contractor shall furnish test sees which shall be subjected to first article inspection (see 4.4). First article inspection samples , properly marked with identifying information. shall be representative of the unit to be furnished to the Government. All subsequent equipment delivered to the Government. Shall conform to these samples in all of their pertinentt physical and performance attributes.

3.2 Qualified products. With respect to all assemblies and component parts requiring product qualification in accordance with the pertinent specifications or drawings listed in and necessary in the construction of this unit, the contractor shall be responsible for using only those products which are listed by part or drawing number as Qualified Products List(s) (QPL) items on the QPL in the referenced specification or which have been - approved for inclusion on such lists (see 4.1.4).

3.3 Materials. Materials used by the contractor shall be high quality, suitable for the purpose, and shall conform to applicable Government specifications, referenced drawings, and standards (see 4.9.1 and 6.3).

3.3.1 Fungistatic materials. All non-metallic materials shall be Inherently fungistatic, as defined by requirement 4 of MIL-STD-454, or treated to resist fungus growth, except when used as components of potted or otherwise moisture sealed assemblies (see 4.9.1).

3.3.2 Dissimilar metals. Dissimilar metals shall not be used in intimate contact unless suitably protected against electrolytic corrosion. The selection and protection of such metal combinations shall be according to requirement 16 of MIL-STD-454 (see 4.9.1).

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3.4 Design and construction.

3.4.1 Production drawings. STE/ICE-R test set shall be fabricated and assembled in accordance with drawings subordinate to 12259266, VTM/Transducer fit Assembly STE/ICE-R (see. 4.9.2).

3.4.2 Standards of manufacture. Processes and parts used in the construction of STE/ICE-R shall be in accordance with the drawings, parts lists, other documents, and subordinate documentation. All integrated circuits shall be screened in accordance with the requirements specified on the individual envelope drawings for each of the integrated circuits (see 4.9.1).

3.4.3 Physical characteristics.

3.4.3.1 Size. The Vehicle Test Meter (VTM) and Transducer Kit (TK) in the stowed configuration shall fit in an envelope 20.00 inches long, 16.00 inches wide, and 14.25 inches high. (see 4.9.3).

3.4.3.2 Weight. The VTM and TK weight, including the storage tray, operating manual, and transit case, shall not exceed 58.0 pounds (see 4.9.4).

3.5 Performance.

3.5.1 Operating voltage. The STE/ICE-R shall operate properly with voltage inputs ranging from 9 to 32 volts (V) direct current (dc). When powered from the Diagnostic Connector Assembly (DCA), the VTM shall be capable of operating in either the DCA or TX mode (see 4.9.5.1).

3.5.2 Confidence test. The VTM when operating in the DCA or TK mode shall completely check all operator interfaces and check the control, switching, and measurement electronics within the VTM. Successful completion of the confidence test shall result in a display showing PASS alternated with the VTM revision code. An unsuccessful confidence test shall result in a confidence test error display beginning with a C followed by three numbers. The numbers shall define the specific faults as described in TM9-4910-571-34&P (see 4.9.5.2).

3.5.3 Test capabilities. The STE/ICE-R, when operating in the DCA or TK mode indicated, shall be capable of performing tests to the control functions, measurement range, display resolution, and accuracies specified in tables I and II (see 4.9.5.3).

3.5.4 Offset correction. The VTM shall be capable of measuring and automatically correcting for offset signals introduced by transducers, test points, wiring and connector pins associated with the particular test as described in table I (see 4.9.5.4).

3.5.5 Error messages. If the VTM needs additional or corrected information before testing can continue, the operator shall be prompted for this information or an error message shall be displayed beginning with an E followed by three numbers. The numbers shall define the specific error as, described in TM 9-4910-571-12&P and TN 9-4910-571-34&P (see 4.9.5.5).

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3.5.6 Status message displays. Status messages shall be displayed as described in TM 9-4910-571-12&P (see 4.9.5.6).

3.5.7 Prompting message display. Prompting messages shall be displayed as described in TM 9-4910-571-12&P (see 4.9.5.7).

3.5.8 DCA fault message. If the DCA system has a fault, the VTM shall define the fault as described in TM 9-4910-571-12&P (see 4.9.5.8).

3.5.9 DCA class. The VTM shall recognize the DCA class referred to in table I by sensing the value of the resistor specified by DCA class in table III (see 4.9.5.9).

3.5.10 Digi-switch entry for compression unbalance tests. It shall be possible to run tests 14 or 15 by entering the necessary vehicle constants by use by the digi-switch as described in TM9-4910-571-12&P (see 4.9.5.10).

3.5.11 Digi-switch entry for percent power test. It shall be possible to run test 13 by entering the necessary vehicle constants by the digi-switch as described in TM9-4910-571-12&P (see 4.9.5.11).

3.5.12 First peak series tests. The VTM shall require just one starter crank to supply the data needed to run each of the tests in first peak series tests 72, 73, 74, and 75 or 76, 77, 78, and 79 (see 4.9.5.12).

3.5.13 Live circuit protection. The VTM shall not be damaged due to an operator attempt to run resistance test 91 or 92 in a live circuit (see 4.9.5.13).

3.5.14 Reprogrammability. The VTM shall be reprogrammable without being disassembled. Each STE/ICE-R VTM shall be capable of reprogramming any other STE/ICE-R VTM as defined in TM9-4910-571-34&P (see 4.9,5.14).

3.5.15 Operational test. The STE/ICE-R system shall be operated at a minimum of 400 hours. The operational profile shall include a minimum of 40 hours production-type inspection and 360 hours of actual vehicle testing (see 4.9.5.15).

3.5.16 Environmental.

3.5.16.1 High temperature (operating). The test set shall be capable of operation without damage or malfunction at a high temperature of 125 degrees Fahrenheit ("F) (without solar radiation) (see 4.9.5.16.1).

3.5.16.2 Low temperature (operating). The test set shall be capable of operation without damage or malfunction at a low temperature of 20°F. For ambient temperatures below 20°F, the test set shall be operated in a shelter (see 4.9.5.16.2).

3.5.16.3 High temperature (nonoperating). The test set shall be capable of being stored and transported in its case without damage at an ambient temperature of plus 160°F (see 4.9.5.16.3).

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3.5.16.4 Low temperature (nonoperating). The test set shall be capable of being stored and transported in its case without damage in ambient temperatures of minus 60°F (see 4.9.5.16.4).

3.5.16.5 Atmospheric pressure (operating). The test set shall be capable of operation without damage or malfunction in an atmospheric pressure of 26.0 to 31.0 inches of mercury (Hg) (see 4.9.5.16.5).

3.5.16.6 Atmospheric pressure (nonoperating). The test set shall be capable of being stored and transported in its case without damage in atmospheric pressures of 3.9 to 31.0 inches of Hg (see 4.9.5.16.6).

3.5.16.7 Relative humidity. The test set shall be capable of operation without damage or malfunction under exposure to relative humidity of as low as 2 % or as high as 100 % (see 4.9.5.16.7).

3.5.16.8 Solar radiation. When tested as specified in 4.9.5.16.8, the test set shall be capable of operation without damage or malfunction under exposure to solar radiation (see 4.9.5.16.8).

3.5.16.9 Fungus. When tested as specified in 4.9.5.16.9, all nonmetallic materials not inherently fungistatic shall evidence no fungus growth which will affect the operation of the test set.

3.5.16.10 Sand and dust. When tested as specified in 4.9.5.16.10, the test set shall show no evidence of abrasion or malfunction.

3.5.16.11 Salt atmosphere. When tested as specified in 4.9.5.16.11, the test set shall show no evidence of corrosion or malfunction.

3.5.16.12 Drop shock. When tested as specified in 4.9.5.16.12, the test set shall evidence no degradation of function. Drop height shall be limited to 4 feet.

3.5.16.13 Vibration. When tested as specified in 4.9.5.16.13, the test set shall evidence no degradation of function.

3.5.16.14 Rain. The test set shall be capable of being stored and transported in its case without damage in rain from 0 to 4.0 inches per hour (see 4.9.5.16.14).

3.5.16.15 Electromagnetic interference susceptibility. The VTM and TK shall operate as specified in the electromagnetic environment of an automotive garage in the presence of operating vehicles and arc welders (see 4.9.5.16.15).

3.6 Marking and identification. Marking and identification shall be in accordance with MIL-STD-130 and the applicable manufacturing drawings. All electrical assemblies shall be serialized (see 4.9.2).

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3.7 Government - furnished property. The following item will be furnished by the Government for the STE/ICE-R set (see 6.5):

TM 9-4910-571-12&P - Operator's and Organizational Maintenance Manual for Simplified Test Equipment for Internal Combustion Engines - Reprogrammable (STE/ICE-R).

3.8 Government-loaned property. The Government-loaned property shall be determined by the Contracting Officer (see 6.2 and 6.5).

3.9 Workmanship. Workmanship shall be in accordance with requirement 9 of MIL-STD-454.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform or witness any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements .

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment shall meet the requirements of MIL-I-45607 and must be capable of repetitive measurements to an accuracy of 10 percent of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662. The contractor will retain on file calibration records for all test equipment, including the period for which the calibration is valid.

4.1.3 Government verification. All quality assurance operations performed by the contractor will be subject to Government verification at unscheduled intervals. Verification will consist of (a) surveillance of the operation to determine that practices, methods, and procedures of the written quality assurance system plan are being properly applied, and (b) Government product inspection to measure the quality of the product offered for

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acceptance. Deviation from the prescribed or agreed upon procedure, or instances of poor practices which might have an adverse effect upon quality of the product, will immediately be called to the attention of the contractor. Failure of the contractor to promptly correct deficiencies shall be cause for suspension of acceptance until corrective action has been made, or until the conformance of the product to prescribed criteria has been demonstrated.

4.1.4 Qualified products. When a part or component is specified to conform to a specification having a Qualified Products List (QPL), the contractor shall make available to the Government documentation of item acquisition from such QPL. The documentation shall include the QPL date and identification of the supplier, purchase order, and quantity.

4.1.5 Quality assurance provisions. In the conduct of inspection, the contractor shall adhere to Quality Assurance Provisions (QAP) and General Quality Assurance Provision (STA Form 458) as applicable and as required by the documents forming part of this specification, including the drawings listed on Quality Assurance Regulation (QAR) 12259265.

4.1.6 Certification. Where certification is required to verify material or component conformance to a specification, the contractor shall furnish such certification along with documented test results and performance and analytical data, as applicable.

4.1.7 Final inspection record (FIR). The contractor shall complete a FIR for each test set inspected at the place of manufacture.

4.2 Classification of inspection:

- a. First article inspection (see 4.4).
 1. Preproduction inspection (see 4.4.1).
 2. Initial production inspection (see 4.4.2).
- b. Quality conformance inspections (QCI) (see 4.5).
- c. Control tests (see 4.6).
- d. Comparison tests (see 4,7).

4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

- a. Air temperature $73 \pm 18^{\circ}\text{F}$
- b. Barometric pressure 28.5 (+2.0, -3.0) inches Hg
- c. Relative humidity $50 \pm 30\%$

4.4 First article inspection. First article inspections shall be performed on preproduction and initial production samples as required. Approval of the first article sample by the Government shall not relieve the contractor of the obligation to supply test sets that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

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4.4.1 Preproduction inspection. When specified (see 6.2), the preproduction sample shall consist of three test sets. Preproduction inspection shall consist of inspection as specified in table IV in the order specified in table V.

4.4.2 Initial production inspection. Unless otherwise specified (see 6.2), the Government shall select three test sets, from the first 20 test sets produced under the production contract for initial production inspection. Initial production units shall be inspected as specified in table IV in the order specified in table V.

NOTE: After completion of the first article test, the approved test sets shall be retained by the contractor for use as a manufacturing standard until completion of the production run. At that time, they will be refurbished and submitted with the last test sets delivered under the contract.

4.4.3 First article inspection failure. Test item deficiencies during, or as a result of, the first article test, shall be cause for rejection of the items until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of the first article test, shall be evidence that all items already produced prior to completion of the first article test are similarly deficient unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. Such deficiencies on all items shall be corrected by the contractor. The Government shall not accept products until first article testing is completed to the satisfaction of the Government.

4.5 QCI. QCI shall be performed on test sets selected in accordance with 4.5.2.1.2 and subjected to the inspection and tests specified in table IV. This will utilize an approved FIR. The FIR shall be made available to the Government for review upon request.

4.5.1 One hundred percent. Each test set shall be subjected to the QCI specified in 4.5.

4.5.2 Acceptable quality level . When authorized by the Government contracting authority, one hundred percent QCI shall be waived. Thereafter, samples shall be selected in accordance with 4.5.2. 1.2 and shall be inspected to determine conformance to the following acceptable quality levels (AQL).

<u>Classification</u>	<u>AQL</u>
Major	1.0
Minor	2.5

4.5.2.1 Sampling.

4.5,2.1,1 Lot formation. An inspection lot shall consist of all the test sets produced in one week submitted at one time for acceptance.

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4.5.2.1.2 Sampling for examination. When sampling is authorized for QCI (see 4.5.2) samples shall be selected in accordance with general inspection level II of MIL-STD-105. Before sampling may be initiated, the contractor shall examine at least 20 consecutively produced test sets. The examination shall establish that the process average percent defective, as defined in MIL-STD-105, is not greater than the specified AQL.

4.5.3 Defects. The following rules shall be applied to the counting of defects.

4.5.3.1 Unclassified defects. All defects that have no effect on function, safety, interchangeability or life, but are considered departures from good workmanship will be noted in writing. Workmanship deficiencies falling within this category and recurring in five consecutive lots, or ten lots or more within a thirty-day period, will be added to the minor defects classification with no increase in AQLs.

4.5.3.2 Recurring major deficiencies. A major deficiency is recurring when the same defect occurs more than once in the same sample, or when the defect occurs in two successive samples. A major defect may be considered recurring when the historical inspection records ("P" chart or approved equivalent) reflect such a condition. Recurring major deficiencies shall be cause for the entire lot or lots to be inspected for the recurring deficiencies. The deficiencies shall be corrected by the contractor when found.

4.5.3.3 Recurring minor deficiencies. A minor deficiency is recurring if it occurs more than twice in the same sample, or when the defect occurs in four successive samples. Recurring minor deficiencies shall be cause for the entire lot or lots to be inspected for the recurring deficiencies and correction shall be accomplished prior to acceptance.

4.6 Control tests. Control tests shall be conducted on one test set, selected by the local Government quality assurance representative, from each lot formation specified in 4.5.2, 1.1 and tested to the control test specified in table IV. If the test set successfully passes all inspections and tests for that production lot, the control test for the following month's production lot may be waived at the discretion of the local Government quality assurance representative, with control tests resuming after that month's production lot.

4.7 Comparison test. The Government may randomly select test sets at anytime during the production contract period and subject these test sets to the comparison tests specified in table IV. Tests shall be conducted by the Government at a site it shall select.

4.8 Failure. Failure of any test set to pass any of the specified inspections or failure to meet inspection AQL levels, as applicable, shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government. Such corrective action required to correct defects will be at no charge to the Government.

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4.9 Methods of inspection.

4.9.1 Materials and construction. Conformance to 3.3 through 3.3.2 and 3.4.2 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, applicable QARs, QAPs, and SQAPs, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.9.2 Defects. Conformance to 3.4.1, 3.6, and 3.7 shall be determined by examination for the defects listed in table V. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.9.3 Size. Measure transit case to verify conformance to 3.4.3.1.

4.9.4 Weight. Weigh the completely stored transit case to verify conformance to 3.4.3.2.

4.9.5 Performance.

4.9.5.1 Operating voltage. To determine conformance to 3.5.1, supply power to the VTM at 9 V dc and 32 V dc. At both voltages, the VTM shall successfully pass the confidence test. TK mode testing with the VTM powered from a DCA shall only be demonstrated during First Article Testing as described in software QAR 12259329.

4.9.5.2 Confidence test. To determine conformance to 3.5.2, confirm performance of the confidence test, both "successful" showing PASS alternated with the VTM revision code, and "unsuccessful" showing fault messages, as described in TM 9-4910-571-34&P. Successful performance (PASS display) will be demonstrated as described in VTM QAR 12259265. Unsuccessful performance will only be demonstrated during First Article Testing as described in software QAR 12259329.

4.9.5.3 Test capabilities. To determine conformance to 3.5.3, all tests, control functions, measurement ranges, display resolutions, and accuracies shown in table I, and accuracies shown in table II shall be demonstrated only during First Article Testing as described in STE/ICE-R software QAR 12259329. Selected tests from table I and accuracies shown in table II shall be demonstrated as described in VTM QAR 12259265.

4.9.5.4 Offset correction. To determine conformance to 3.5.4, confirm that VTM automatically provides zeroing voltages to compensate for selected offset voltages by running tests described in software QAR 12259329.

4.9.5.5 Error messages. To determine conformance to 3.5.5, confirm all error messages described in TM 9-4910-571-12&P and TM 9-4910-571-34&P by introducing conditions to cause the messages as described in VTM QAR 12259329.

4.9.5.6 Status message displays. To determine conformance to 3.5.6, confirm all status message displays described in TM 9-4910-571-12&P by introducing conditions to cause the display as described in QAR 12259329.

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4.9.5.7 Prompting message displays. To determine conformance to 3.5.7, confirm all prompting message displays described in TM 9-4910-571-12&P by introducing conditions to cause the display as described in software QAR 12259329.

4.9.5.8 DCA fault message. To determine conformance to 3.5.8, confirm all DCA fault messages described in TM 9-4910-571-12&P by introducing conditions to cause the display as described in software QAR 12259329.

4.9.5.9 DCA class. To determine conformance to 3.5.9, confirm that the VTM recognizes a DCA class by resistor value by running tests as described in VTM QAR 12259265.

4.9.5.10 Digi-switch entry for compression unbalance tests. To determine conformance to 3.5.10, introduce the necessary compression unbalance constants to the VTM by digi- switch as described in software QAR 12259329, to confirm that tests 14 and 15 can be run.

4.9.5.11 Digi-switch entry for percent power test. To determine conformance to 3.5.11, introduce percent power test constants to the VTM by digi-switch as described in software QAR 12259329, to confirm that test 13 can be run.

4.9.5.12 First peak series tests. To determine conformance to 3.5.12, introduce one starter crank signal, as described in software QAR 12259329, to confirm that the prescribed series (tests 72, 73, 74, and 75, or tests 76, 77, 78, and 79) of the first peak tests can be run from the data of one starter crank.

4.9.5.13 Live circuit protection. To determine conformance to 3.5.13, run resistance measurements tests 91 and 92 in a live 24 ± 6 V dc circuit to confirm there will be no damage to the VTM.

4.9.5.14 Reprogrammability. To determine conformance to 3.5.14, program the VTM using procedures defined in TM 9-4910-571-34&P. After programming, run QCI tests in table IV,

4.9.5.15 Operational test. To determine conformance to 3.5.15, do all the performance tests specified in QAR 12259265. Repeat as necessary to accumulate a minimum of 40 hours. Perform STE/ICE-R test on the M151, M113A2, M44/M35, and M48/M60 vehicles in accordance with the tests listed on their vehicle test cards to accumulate a minimum of 360 hours. It is permissible to leave the VTM on overnight connected to a TK transducer to accumulate test hours during vehicle testing,

4.9.5.16 Environmental conditions. The test set shall pass the confidence test of 4.9.5.2 after each environmental test.

4.9.5.16.1 High temperature (operating). To determine conformance to 3.5.16.1, the test set shall be subjected to high temperature test specified by method 501.2, procedure II (hot category), of MIL-STD-810 and tested to 4.9.5.3.

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4.9.5.16.2 Low temperature (operating). To determine conformance to 3.5.16.2, the test set shall be subjected to low temperature test specified by method 502.2, procedure II, of MIL-STD-810 and tested to 4.9.5.3.

4.9.5.16.3 High temperature (nonoperating). To determine conformance to 3.5.16.3, the test set shall be subjected to high temperature test specified by method 501.2, procedure I, of MIL-STD-810.

4.9.5.16.4 Low temperature (nonoperating). To determine conformance to 3.5.16.4, the test set shall be subjected to low temperature test specified by method 502.2, procedure I, of MIL-STD-810.

4.9.5.16.5 Atmospheric pressure (operating). To determine conformance to 3.5.16.5, the test set shall be subjected to atmospheric test by method 500.2, procedure II, of MIL-STD-810 and tested to 4.9.5.3.

4.9.5.16.6 Atmospheric pressure (nonoperating). To determine conformance to 3.5.16.6, the test set shall be subjected to atmospheric test by method 500.2, procedure I, of MIL-STD-810.

4.9.5.16.7 Relative humidity. To determine conformance to 3.5.16.7, the test set shall be subjected to the humidity test specified by method 507.2, procedure I, of MIL-STD-810, natural non-hazardous (cycle 1) and tested to 4.9.5.3.

4.9.5.16.8 Solar radiation. To determine conformance to 3.5.16.8, the test set shall be subjected to the applicable solar radiation test specified by method 505.2, procedure I (hot cycle), of MIL-STD-810.

4.9.5.16.9 Fungus. To determine conformance to 3.5.16.9, the test set shall be subjected to the applicable fungus test specified in method 508.3 of MIL-STD-810 (28 day test).

4.9.5.16.10 Sand and dust. To determine conformance to 3.5.16.10, the test set shall be subjected to the test specified by method 510.2 of MIL-STD-810.

4.9.5.16.11 Salt atmosphere. To determine conformance to 3.5.16.11, the test set shall be subjected to the salt atmosphere test specified by method 509.2 of MIL-STD-810.

4.9.5.16.12 Drop shock. To determine conformance to 3.5.16.12, the test set shall be subjected to the drop shock test specified by method 516.3, procedure IV, of MIL-STD-810 and tested to 4.9.5.3 after the drop test.

NOTE: The test set shall be tested outside of its transit case, and the total number of 48 inch drops shall be eight. The test set shall be dropped once on each face and once in each of two diagonally opposite corners. The test set shall be operating during one of the eight drops. The test set confidence test shall be performed after each drop.

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4.9.5.16.13 Vibration- To determine conformance to 3.5.16.13, the test set shall be subjected to the vibration test specified by method 514.3, procedure I, category 1, secure cargo (5 ton M813). Use a composite of figures 514.3-7 through 514.3-9 of MIL-STD-810 (duration 500 miles). The test set shall be tested to 4.9.5.3 after the vibration test.

4.9.5.16.14 Rain. To determine conformance to 3.5.16.14, the test set shall be subjected to rain test by method 506.2, procedure I, of MIL-STD-810D.

4.9.5.16.15 Electromagnetic interference susceptibility. To determine conformance to 3.5.16.15, the test set and transducer kit shall be tested in accordance with the applicable provisions of MIL-E-6051.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging standard or packaging data sheet specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. The test equipment covered by this specification is intended for use in analyzing the performance of internal combustion engines, including engine power and compression, fuel, air induction, ignition, starting systems and charging systems.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Military part number.
If first article samples are not required (see 3.1).
- c. Specify the Government loaned property (see 3.8).
- e. If responsibility for inspection shall be other than as specified (see 4.1).
- f. If responsibility for inspection equipment shall be other than as specified (see 4.1.2).
- g. If inspection conditions shall be other than as specified (see 4.3).
- h. If preproduction inspection is required (see 4.4.1).
- i. If initial production inspection is not required (see 4.4.2).
- j. Selection of applicable level of packaging and level of packing (see 5.1).

6.3 Recycled materials. The use of recycled materials which meet the requirements of the applicable material specifications without jeopardizing the intended use of the item shall be encouraged (see 3.3).

6.4 Inspection for first article. When a first article inspection is required, the first article should consist of three units (see 6.2). One of these units will be used for performance verification, and two of these units will be used for environmental verification.

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6.5 Government-furnished and Government-loaned property.

6.5.1 Government-furnished property. The contracting officer should arrange to furnish the property listed in 3.7,

6.5.2 Government-loaned property. The contracting officer should arrange to loan the property listed in 3.8.

6.6 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

TABLE I. STE/ICE-R VTM Hardware performance specifications.

#	Name	TK Mode or Applicable DCA Classes											Measurement Range	Display Resolution	VTM Measurement Accuracy (+-%I)+(-%FS)			
		1	2	3	4	5	6	7	8	9	0	1				1	1	
01 \$	Display RPM w/Next																	
01 \$	Measurement																	
01 \$		X	X	X	X	X	X	X	X	X	X	X	X	X				
02 \$	Display Minimum																	
02 \$	Value of Next																	
02 \$	Measurement	X	X	X	X	X	X	X	X	X	X	X	X	X				
03 \$	Display Maximum																	
03 \$	Value of Next																	
03 \$	Measurement	X	X	X	X	X	X	X	X	X	X	X	X	X				
04 \$	Display Peak-Peak																	
04 \$	Value of Next																	
04 \$	Measurement	X	X	X	X	X	X	X	X	X	X	X	X	X				
05 \$	SI Full Power																	
05 \$	Simulation																	
05 \$		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
06 \$	Display T ₂₀																	
06 \$	Measurements																	
06 \$		X	X	X	X	X	X	X	X	X	X	X	X	X				

Notes: %I - Percentage of Input Signal in Units being Measured (e.g. DEG., PSI, etc.)
 %FS - Percentage of Highest Value in Measurement Range (e.g. 5000 RPM, 32 VDC, etc.)
 SI - Spark Ignition
 CI - Compression Ignition
 (a) - DCA indicator set for 1 pulse per 1 revolution
 (b) - DCA indicator set for 1 pulse per 2 revolutions
 (c) - Test is to be run for all TK IDs, 1 through 25.
 (d) - Accuracy of result is dependent up amplitude of starter current:
 0 - 1500 Amps range.
 (e) - Accuracy of result is dependent up amplitude of starter current:
 0 - 3000 Amps range.
 * - Zero offset test required.
 + - Zero offset test optional but must be run for accuracy listed.
 \$ - These tests are expected to be demonstrated only during First Article Test.
 N.A. - Not Applicable
 TBD - To Be Determined

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TABLE I. STEC/ICE-R VTM Hardware performance specifications - continued.

Item #	Name	TK Mode or Applicable DCA Classes											Measurement Range	Display Resolution	VTM Measurement Accuracy (+- %I)+(+/- \$FS)				
		1	2	3	4	5	6	7	8	9	0	1				1	1	1	
25*	Fuel Return Pressure	X															0 - 100 PSI	0.1 PSI	1.5
25**	Fuel Return Pressure	X															0 - 100 PSI	0.1 PSI	3.5
26	Fuel Filter PD																Vehicle dependent set point	pass/fail	FAIL < 1.0 konm 47 konm < PASS otherwise indeterminate
26		X																	
26		X																	
27	Fuel Solenoid Voltage	X															0 - 32 VDC	0.1 VDC	0.0
27	Voltage Test # 1																0 - 32 VDC	0.1 VDC	0.0
27		X	X	X	X	X	X	X									0 - 32 VDC	0.1 VDC	0.0
27																	0 - 32 VDC	0.1 VDC	0.0
28*	Air Cleaner PD (R)																0 - 60 In. water	0.1 in. water	1.5
28**		X	X	X	X	X	X	X									0 - 60 In. water	0.1 in. water	1.5
29**	Air Cleaner PD (L)																0 - 60 In. water	0.1 in. water	1.5
30*	Turbo Pressure (R)																0 - 50 In. Hg	0.1 in. Hg	1.5
30**		X	X	X	X	X	X	X									0 - 50 In. Hg	0.1 in. Hg	1.5
31*	Turbo Pressure (L)																0 - 50 In. Hg	0.1 in. Hg	1.5
31**		X	X	X	X	X	X	X									0 - 50 In. Hg	0.1 in. Hg	1.5
32*	Airbox Pressure																0 - 20 In. Hg	0.1 in. Hg	1.5
32*		X															0 - 50 In. Hg	0.1 in. Hg	1.5
32**																	0 - 20 In. Hg	0.1 in. Hg	1.5
32**		X															0 - 50 In. Hg	0.1 in. Hg	1.5
33**	Manifold Vacuum																0 - 30 In. Hg	0.1 in. Hg	1.5
34**	Manifold Vacuum																0 - 30 In. Hg	0.1 in. Hg	1.5
34**	Variation																		
35**	Engine Oil Pressure																0 - 100 PSI	0.1 PSI	1.5
36**	Engine Oil Filter PD																0 - 25 PSI	0.1 PSI	1.5

Notes: %I - Percentage of Input Signal in Units being Measured (e.g. DEG., PSI, etc.)
 %FS - Percentage of Highest Value in Measurement Range (e.g. 5000 RPM, 32 VDC, etc.)

SI - Spark Ignition

CI - Compression Ignition

(a) - DCA indicator set for 1 pulse per 1 revolution

(b) - DCA indicator set for 1 pulse per 2 revolutions

(c) - Test is to be run for all TK IDs, 1 through 25.

(d) - Accuracy of result is dependent up amplitude of starter current:

0 - 1500 Amps range.

(e) - Accuracy of result is dependent up amplitude of starter current:

0 - 3000 Amps range.

* - Zero offset test required.

+ - Zero offset test optional but must be run for accuracy listed.

\$ - Inese tests are expected to be demonstrated only during First Article Test.

N.A. - Not Applicable

TBD - To Be Determined

TABLE I. STEC/ICE-R VTM Hardware performance specifications - continued.

#	Name	TK Mode or Applicable DCA Classes											Measurement Range	Display Resolution	VTM Measurement Accuracy (+- %I) (+- %FS)			
		1	2	3	4	5	6	7	8	9	0	1				1	1	1
62	Display DCA ID number	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1 - 14	1	(+- 0) (+- 0)
63	Display J2 TK transducer ID number	TK-J2 MODE (c)											1 - 25	1	(+- 0)			
64	Display J3 TK transducer ID number	TK-J3 MODE (c)											1 - 25	1	(+- 0)			
65	VRS Placement Test	TK-J2 MODE													N.A.			
65		TK-J3 MODE													N.A.			
66	Vehicle test meter confidence test														N.A.			
67	Battery Voltage	X														10 - 32 VDC	0.1 VDC	0.0
67			X	X	X	X	X	X	X	X	X	X	X	X	X	0 - 32 VDC	0.1 VDC	0.0
67	Voltage Test # 2															10 - 32 VDC	0.1 VDC	0.0
67																0 - 32 VDC	0.1 VDC	0.0
68	Starter Motor Voltage															0 - 32 VDC	0.1 VDC	0.0
68		X	X	X	X	X	X	X	X	X	X	X	X	X	X	0 - 32 VDC	0.1 VDC	0.0
68	Voltage Test # 3															0 - 32 VDC	0.1 VDC	0.0
68																0 - 32 VDC	0.1 VDC	0.0
69	Starter Negative Cable Drop															0 - 2 VDC	0.01 VDC	0.0
69		X	X	X	X	X	X	X	X	X	X	X	X	X	X	0 - 2 VDC	0.01 VDC	0.0
69	Ground Reference Volt															0 - 2 VDC	0.01 VDC	0.0
70	Starter Solenoid Volt															0 - 32 VDC	0.1 VDC	0.0
70		X	X	X	X	X	X	X	X	X	X	X	X	X	X	0 - 32 VDC	0.1 VDC	0.0
70	Voltage Test # 4															0 - 32 VDC	0.1 VDC	0.0
70																0 - 32 VDC	0.1 VDC	0.0
71	Starter Current (Average)															0 - 2000 Amp	1 Amp	1.5
71		X	X	X	X	X	X	X	X	X	X	X	X	X	X	0 - 1000 Amp	1 Amp	1.5
71																0 - 2000 Amp	1 Amp	1.5

Notes: %I - Percentage of Input Signal in Units being Measured (e.g. DEG., PSI, etc.)
 %FS - Percentage of Highest Value in Measurement Range (e.g. 5000 RPM, 32 VDC, etc.)
 SI - Spark Ignition
 CI - Compression Ignition
 (a) - DCA indicator set for 1 pulse per 1 revolution
 (b) - DCA indicator set for 1 pulse per 2 revolutions
 (c) - Test is to be run for all TK IDs, 1 through 25.
 (d) - Accuracy of result is dependent up amplitude of starter current: 0 - 1500 Amps range.
 (e) - Accuracy of result is dependent up amplitude of starter current: 0 - 3000 Amps range.
 * - Zero offset test required.
 † - Zero offset test optional but must be run for accuracy listed.
 N.A. - Not Applicable
 TBD - To Be Determined

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TABLE II, STE/ICE-R accuracies at room temperature.

#	Test name	Range	% of Reading	Within +/-	Units
10	Engine RPM	50 to 499	.2	1	RPM
		500 to 5000	.04	2	
11	Cranking RPM	50 to 499	.2	1	RPM
		500 to 5000			
16	Dwell Angle	10 to 72	1.4	1	Degrees
17	Points Voltage	0 to 2	.5	.01	Volts
45	Vacuum	0 to 4.9	4	.2	Inches of Mercury
		5 to 9.9	3	.3	
		10 to 19.9	1	.3	
		20 to 30	1.7	.5	
45	Pressure	0 to 4.9	4.1	.2	Inches of Mercury
		5 to 9.9	4	.4	
		10 to 19.9	2.5	.5	
		20 to 34.9	1.7	.6	
		35 to 50	1.8	.9	
48	Pressure	0 to 14	7.1	1	Inches of Water
		15 to 49	6.1	3	
		50 to 99	4	4	
		100 to 150	3.3	5	
49	Pressure	0 to 1.9	5.3	.1	PSIG
		2 to 4.9	4.1	.2	
		5 to 9.9	3	.3	
		10 to 17.5	1.7	.3	
		17.6 to 25	2	.5	
50	Pressure	0 to 49	4	2	PSI
		50 to 199	1.5	3	
		200 to 399	1.3	5	
		400 to 699	.9	6	
		700 to 1000	.8	8	
67	Battery voltage	10 to 14.9	.7	.1	Volts
		15 to 22.4	.5	.1	
		22.5 to 32	.3	.1	

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TABLE II. STE/ICE-R accuracies at room temperature - Continued.

#	Test name	Range	% of Reading	Within +/-	Units
89	DC Voltage	0 to .19	5.3	.01	Volts
		.2 to .49	2	.01	
		.5 to .99	1	.01	
		1 to 1.99	1	.02	
		2 to 2.99	1	.03	
		3 to 4.49	.67	.03	
		5 to 9.9	1	.1	
		10 to 19.9	.5	.1	
		20 to 29.9	.67	.2	
30 to 45	.44	.2			
90	DC Amps	0 to 4.9	8.2	.4	Amps
		5 to 9.9	11.1	1.1	
		10 to 19.9	10.1	2	
		20 to 39.9	8.3	3.3	
		40 to 69.9	7.2	5	
		70 to 99.9	7	7	
		100 to 149.9	6.7	10	
		150 to 299	4.3	13	
		300 to 499	3	15	
		500 to 749	2.7	20	
		750 to 999	3.4	34	
		1000 to 1199	5.3	63	
1200 to 1500	8	120			
91	Resistance	0 to 9	11.1	1	Ohms
		10 to 24	8.3	2	
		25 to 49	4.1	2	
		50 to 99	3	3	
		100 to 199	1.5	3	
		200 to 299	1.3	4	
		300 to 599	.7	4	
		600 to 999	.5	5	
1000 to 1500	.4	6			
92	Resistance	0 to .49	8.2	.04	Kohms
		.50 to 2.49	2.4	.06	
		2.50 to 7.49	.8	.06	
		7.50 to 14.99	.5	.07	
		15 to 24.99	.3	.07	
		25 to 40	.2	.08	
93	AC Voltage	0 to 2.4	8.3	.2	Volts
		2.5 to 7.4	2.7	.2	
		7.5 to 14.9	1.3	.2	
		15 to 24.9	.8	.2	
		25 to 35	.6	.2	

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TABLE II. STE/ICE-R accuracies at room temperature - Continued.

#	Test name	Range	% of Reading	Within +/-	Units
95	AC Current	5 to 29.9	4.3	1.3	Amps
		30 to 69.9	5	3.5	
		70 to 199	5	10	
		200 to 399	5.8	23	
		400 to 700	6	42	
96	AC Frequency (cable W2)	40 to 99	.4	.2	Hertz
		100 to 199	.1	.2	
		200 to 349	.1	.3	
		350 to 500	.05	.3	
97	AC Frequency	40 to 99	.2	.2	Hertz
		100 to 199	.1	.2	
		200 to 349	.05	.2	
		350 to 500	.06	.3	

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TABLE III. DCA code resistors.

DCA Class	Vehicles	Vehicle Code Resistor Value OHM + 0.5 percent
1	M551, M44A2, M35A2, HMMM WV	0.0
2	M113A1, M561	61.9
3	M809, LVTP7A1, M2, M3, M939, M9ACE, LAV	127.0
4	CUCV	196
5	M60A1, M48A3	267
6	M107, M109, M110, M578, LVTP7, M977	348
7		432
8	M123A1C, M915, M915A1	523
9	M520, M1001, M1002	619
10	M151A2, M880	732
11		845
12		976
13		1100
14		1270

Refer to the STE/ICE-R DCA Design Guide for interface information concerning DCAS.

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TABLE IV. Classification of inspections.

Title	Requirements	Inspection	First article sample	QCI	Control	Comparison
Materials and construction	3.3 thru 3.3.2 and 3.4.2	4.9.1	X			
Defects (see table)	3.4.1	4.9.2	X	X	X	X
Size	3.4.3.1	4.9.3	X	X	X	X
Weight	3.4.3.2	4.9.4	X	X	X	X
Operating voltage	3.5.1	4.9.5.1	X	X	X	X
Confidence test	3.5.2	4.9.5.2	X	X	X	X
Test capabilities	3.5.3	4.9.5.3	X	X	X	X
Offset correction	3.5.4	4.9.5.4	X			
Error messages	3.5.5	4.9.5.5	X			
Status message displays	3.5.6	4.9.5.6	X			
Prompting message displays	3.5.7	4.9.5.7	X			
DCA fault message	3.5.8	4.9.5.8	X			
DCA class	3.5.9	4.9.5.9	X			
Digi-switch entry for compression unbalance tests	3.5.10	4.9.5.10	X			
Digi-switch entry for percent power test	3.5.11	4.9.5.11	X			
First peak series tests	3.5.12	4.9.5.12	X			
Live circuit protection	3.5.13	4.9.5.13	X			
Reprogrammability	3.5.14	4.9.5.14	X			
Operational test	3.5.15	4.9.5.15	X			
High temperature (operating)	3.5.16.1	4.9.5.16.1	X		X	
Low temperature (operating)	3.5.16.2	4.9.5.16.2	X		X	

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TABLE IV. Classification of inspections - Continued.

Title	Requirements	Inspection	First article sample	OCI	Control	Comparison
High temperature (nonoperating)	3.5.16.3	4.9.5.16.3	X		X	
Low temperature (nonoperating)	3.5.16.4	4.9.5.16.4	X		X	
Atmospheric pressure (operating)	3.5.16.5	4.9.5.16.5	X		X	
Atmospheric pressure (nonoperating)	3.5.16.6	4.9.5.16.6	X		X	
Relative humidity	3.5.16.7	4.9.5.16.7	X		X	
Solar radiation	3.5.16.8	4.9.5.16.8	X			
Fungus	3.5.16.9	4.9.5.16.9	X			
Sand and dust	3.5.16.10	4.9.5.16.10	X			
Salt atmosphere	3.5.16.11	4.9.5.16.11	X			
Drop shock	3.5.16.12	4.9.5.16.12	X			
Vibration	3.5.16.13	4.9.5.16.13	X			
Rain	3.5.16.14	4.9.5.16.14	X			
Electromagnetic interference susceptibility	3.5.16.15	4.9.5.16.15	X			

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TABLE V. Sequence and inspections applied to each sample,

Test sequence	Paragraph number	Preproduction sample			Initial Production sample		
		1	2	3	1	2	3
OCI	4.5	X	X	X	X	X	X
Size	4.9.3	X	X	X	X	X	X
Weight	4.9.4	X	X	X	X	X	X
Performance	4.9.5.1 thru 4.9.5.14	X			X		
Temperature							
High nonoperating	4.9.5.16.3		X	X		X	X
Low nonoperating	4.9.5.16.4		X	X		X	X
High operating	4.9.5.16.1		X	X		X	X
Low operating	4.9.5.16.2		X	X		X	X
Solar radiation	4.9.5.16.8		X	X		X	X
Atmospheric pressure							
Nonoperating	4.9.5.16.6		X	X		X	X
Operating	4.9.5.16.5		X	X		X	X
Relative humidity	4.9.5.16.7		X	X		X	X
Rain	4.9.5.16.14		X	X		X	X
Sand and dust	4.9.5.16.10		X	X		X	X
Salt atmosphere	4.9.5.16.11		X	X		X	
Vibration	4.9.5.16.13		X	X		X	
Electromagnetic interference							
susceptability	4.9.5.16.15		X	X		X	X
Operational test	4.9.5.15		X	X		X	X
Drop shock	4.9.5.16.12		X	X		X	X
Fungus	4.9.5.16.9		X			X	

NOTE: Test sequence may be altered to minimize cost or schedule with the exception of Vibration and Drop Shock, which are last.

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TABLE VI. Classification of defects.

Category	Defect	Method of examination
Critical	None	
<u>Major</u>	<u>AQL 1.0% Defective</u>	
101	Dimensions affecting interchangeability, out of tolerance (see 3.4.1).	SIE <u>1/</u>
102	Faulty workmanship affecting function (see 3.7).	Visual
103	Marking, improper (see 3.6).	Visual
<u>Minor</u>	<u>AQL 2.5% Defective</u>	
201	Dimensions not affecting interchangeability, out of tolerance (see 3.4.1).	SIE <u>1/</u>
202	Faulty workmanship affecting appearance (see 3.7).	Visual

1/ SIE = Standard Inspection Equipment.

Custodian:
Army - AT

Preparing activity:
Army - AT

(Project No. 4910-A644)

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