MILITARY SPECIFICATION

ELECTRON TUBES,

GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the general requirements and ratings for electron tubes used by the military departments.

* 1.2 Classification. This specification is applicable to electron tubes classified in, but not limited to, the categories listed below. The main category into which each tube is classified shall be indicated in the title of the tube specification sheet (TSS). The subcategory shall be included as the initial item under the description heading; for example, ELECTRON TUBE, KLYSTRON - - - - - DESCRIPTION: Reflex oscillator.

Beam Switching

Cathode Ray
- Electrostatic or Magnetic Focus
- Electrostatic or Magnetic Deflection
- Multigun (specify number of guns)

Cathode-Ray Charge Storage
- Visual Output (direct view)
- Electrical Output

Cold Cathode
- Triode
- Rectifier

Corona Voltage Regulators

Cross Field Amplifier

Electron Multiplier

Electron Ray Indicator

Gas-Switching (microwave)
- ATR (antitransmit-receive)
- Dual-TR (transmit-receive)
- Pre-TR
- TR

Graphic Indicator
- Numerical Indicator

Gyrotron

Ignitron

Image Converter

Image Orthicon

Klystron
- Reflex Oscillator
- Amplifier
  - Pulse
  - Continuous Wave (CW)

Magnetron
- Pulse
- Coaxial
- Continuous Wave (CW)
- Voltage Tunable

M-Type Backward Wave

Negative Grid (microwave)

Noise Source
- Vacuum Diode
- Gas Discharge

O-Type Backward Wave

Phototube
- Gas
- Infrared
- Multiplier

Power or Transmitting
- Diode
- Triode
- Tetrode
- Pentode
- Rectifier

Pulse Modulator
- Hydrogen
- Vacuum

Radiation Counter
- Geiger Mueller

Receiving
- Diode
- Triode
- Tetrode
- Pentode (subminiature, miniature, multigrid, twin, and so forth)
- Rectifier
- Power

Stabilotron

Thyratron

Traveling Wave (or forward wave)

Vidicon

Voltage Regulator
- Glow Discharge

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Electronic Systems Command, ATTN: ELEX 8111, Department of the Navy, Washington, DC 20363, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-I-10 - Insulating Compound, Electrical, Ceramic, Class L.
MIL-E-75 - Electron Tubes, Packaging of.

(See supplement 1 for listing of tube specification sheets and applicable individual tube types.)

STANDARDS

* MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-1311 - Test Methods for Electron Tubes.

(Copies of specifications, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.1.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

2.2 Other publication. The following document forms a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

RS-235 - Color Codes for Microwave Devices with Wire Leads.

(Application for copies should be addressed to the Electronic Industries Association, Engineering Office, 2001 Eye Street, N.W., Washington, DC 20006.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Tube specification sheet (TSS). The individual electron tube requirements shall be as specified herein and in accordance with the applicable TSS. The following order of precedence and exceptions shall govern:

a. Order of precedence: In the event of conflict between this specification, MIL-STD-1311, and the TSS, and unless otherwise specified (see exceptions below), the TSS shall take precedence. In determining applicable test conditions, however, the following order shall govern:

(1) The test condition specified on the TSS for a particular test method, as indicated in the "Conditions" column.

(2) The test condition specified in a particular test method.

(3) The general test conditions specified on the TSS (usually located on the first page).

(4) The test conditions specified in MIL-STD-1311 under "General" instructions and conditions.

b. Exceptions:

(1) Limited coordination (LC) specification. The marking requirements of this specification shall apply to all tubes acquired to single-service (LC) specifications. (The "JAN" prefix shall be used in lieu of "USA", "USAF", or "USN".)

(2) Military designator "M". Use of the letter "M" as a military designator on tubes and specification sheets shall be discontinued and where already assigned, shall be disregarded.

* (3) MIL-STD-1311, method 1501A. If there are conflicting requirements between this specification, MIL-STD-1311, and the TSS, the TSS requirements shall be secondary.

3.1.1 General reference. When the term "as specified" or "specified" is used herein, without reference to a specific document or location, the intended reference is to the TSS.

3.1.2 Tests. General test conditions and test methods contained in MIL-STD-1311 form a part of this specification. Unless otherwise specified, any reference to a test method by use of a four-digit number shall be to methods of MIL-STD-1311.

3.1.2.1 Destructive tests. Tubes used for conducting tests designated as destructive below, or in the test method, shall not be delivered under contract or order for use by the Government. Except for stability, survival rate, and group S-multiple short life, life tests shall be considered destructive. In addition, the following are designated as destructive:

Test	Method
Sweep frequency vibration fatigue	1031
Vibration fatigue	1031
Vibration, endurance at resonance 1/	1032
Shock	1041
Base pin solder depth 2/	1111
Lead fatigue (subminiature tube)	1116
Glass-to-lead seal strain	1119
Filament burnout	1202
Mechanical tuning fatigue	4223

1/ When specified on the TSS.
2/ If X-ray techniques are not used.

3.2 Qualification. Unless exception is taken by the TSS, all tubes furnished under this specification shall be products which have been tested and passed the qualification requirements specified herein and have been listed or approved for listing on the Qualified Products List (QPL-1) at the time set for opening of bids (see 4.2 and 6.2).

* 3.2.1 First article. When specified, a sample shall be subjected to first article inspection (see appendix F).

3.3 Definitions. For the purpose of this specification, the definitions of appendix A shall apply.

3.4 Abbreviations and symbols. For the purpose of this specification, the abbreviations and symbols of appendix B shall apply.

3.5 Design, construction, and dimensions. The design, construction, and dimensions of an electron tube shall be as specified herein (appendixes C and D) and on the TSS.

* 3.5.1 Base material. Unless otherwise specified, all electron tube bases shall be fabricated from material having suitable physical electrical and mechanical properties to meet all the specified requirements of the TSS.

3.5.2 Base connections. Electrode connections to base pins shall be as specified. Pins designated as "int con" are not suitable for connection to external circuits. Pins designated as "nc" shall have no connections made to them within the tube.

3.5.3 Base cementing. Receiving tubes and cathode-ray tubes which have leads soldered into the pins shall have the base cemented to the envelope. Base cement is not required for metal tubes, or metal enclosed glass tubes with envelope skirt mechanically crimped to the base, or for button header solid lead receiving tubes.

3.5.4 Color coding. Insulation on flying leads for microwave tubes shall be color coded in accordance with EIA Standard RS-235.

* 3.5.5 Absolute ratings. The absolute ratings specified on the TSS shall be as specified in 6.4.

3.6 Marking. All tubes shall be marked in a legible and permanent manner on the base, envelope, or shell with the information specified in 3.6.1 through 3.6.11, as applicable. Additional marking (including commercial designation) may be applied, providing it does not interfere with the marking required herein and is completely separated therefrom (see 4.4 and method 1105).

a. Permanent-marking requirements: The following information, as applicable, shall be marked on the tube, as specified in 3.6b.

   (1) Type number.

   (2) "JAN" prefix.

   (3) Lot identification.

   (4) Service-life guarantee.

b. Permanent marking: The information specified in 3.6a shall be applied to the tube by a process, such as grit blasting, etching, baked-enamel silk screening, permanent adhesive decals or labels, or any other method that will assure permanence equal to these methods of marking. The marking shall be permanent to the degree that removal of the information can only be accomplished by deliberate mutilation of the marking, or destruction of the tube.

c. Secondary marking requirements: Required information, other than that specified in 3.6a, shall be marked on the tube by any method that will assure legibility after prolonged use of the tube.

3.6.1 Tube designation. The tube shall be designated by the type number as indicated on the TSS. The tube shall be marked with this type number in accordance with the requirements specified herein and by the TSS.

* 3.6.2 "JAN" prefix. The United States Government has adopted, and is exercising legitimate control over the certification marks "JAN" and "J", respectively, to indicate that items so marked or identified are manufactured to, and meet all the requirments of military specifications. Accordingly, electron tubes procured to, and meeting all of the criteria specified herein and in applicable TSS's shall bear the

certification mark "JAN" except that electron tubes too small to bear the certification mark "JAN" shall bear the letter "J". The "JAN" or "J" shall be placed immediately before the type number except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the type number. Tubes furnished under contracts or orders which either permit or require deviation from the conditions or requirements specified herein or in applicable TSS's shall not bear "JAN" or "J". In the event a tube fails to meet the requirements of this specification and the applicable TSS's, the manufacturer shall remove the "JAN" or the "J" from the sample tested and also from all tubes represented by the sample. The "JAN" or "J" certification mark shall not be used on tubes procured to contractor drawings or specifications. The United States Government has obtained Certificate of Registration No. 504,860 for the certification mark "JAN". Application or presence of the "JAN" brand shall constitute certification by the tube supplier, that all tests and inspections required by this specification and the applicable TSS, have been satisfactorily completed and that complete, authenticated test data will be retained by the manufacturer for not less than three years and be made available upon request for Government review.

3.6.3 Lot identification. Each nonserially numbered tube shall be marked with a lot-identification code so that tubes of a given lot (see Submission of Product section of MIL-STD-105) may be identified. Lot-identification codes shall be limited to the use of Arabic numerals and English letters, or combinations of both. The size of the characters of the lot identification shall be not larger than the size in the date code.

3.6.4 Manufacturer's identification. The tube shall be marked with the name, initials, or trademark, of only the bona fide tube manufacturer who has contracted under this specification to supply tubes directly to either the Government agencies or their equipment manufacturers, and at whose plants or establishments the specification tests have been performed and inspection made on such tubes contracted to be supplied. The marking shall not detract from the tube designation. The equipment manufacturer's name or trademark shall not appear on the tube unless the tube manufacturer supplying the tube for the contract is also the equipment manufacturer.

3.6.5 Manufacturer's factory source code. The manufacturer shall include the factory code as given in Cataloging Handbooks H4-1, H4-2, and H4-3 (Federal Supply Code for Manufacturers). The size of the characters of the factory source code shall not be larger than the size used in the date code.

3.6.6 Acceptance date. Each tube shall be marked with its acceptance date; the date the tube is accepted for shipment to the Government or to its contractor(s). The date-code shall consist of a four digit number; the first two numbers shall be the last two digits of the calendar year of acceptance, the last two digits shall indicate the calendar week of acceptance. Weeks 1 through 9 shall be preceded by a zero. The acceptance date marking may be performed on a quarterly basis provided the date used is in advance of the acceptance time. The characters shall be smaller than those in the tube designation and spacing between the digits shall not exceed 0.062 inch (1.57 mm). If allowable marking area is inadequate, the marking of the acceptance date on the tube shall not be required. The date of unit packaging, as shown in MIL-E-75 for all interior package marking, shall be used as the acceptance date.

3.6.7 Country of origin. The phrase "Made in U.S.A.", or the abbreviation "U.S.A.", shall be marked in characters smaller than those used for the tube designation. For tubes made in other countries, the phrase shall be changed accordingly. If the allowable marking area is inadequate, the marking of the country of origin shall not be required. The marking of the country of origin on the unit package, as specified in MIL-E-75 for all interior package marking, shall be used to meet this requirement.

* 3.6.8 Radioactive marking. Tubes with intentionally added radioactive isotopes shall be marked when required by and in accordance with MIL-STD-129. Where physical size precludes printing all required data on the tube itself, the standard radiation symbol (Code of Federal Regulation, Title 10 Atomic Energy) or the radiation symbol and the words "accountability required", where applicable may be adopted. (See appendix B for correct symbol.)

3.6.9 Service-life guarantee. Tubes sold under service-life guarantees shall be marked with the manufacturer's serial number, contract number, and the number of hours guaranteed (see 4.6.6 and 6.1).

3.6.10 Inadequate marking area. Tubes having inadequate marking areas for all applicable markings (due to size or effects on operating characteristics of the tube) shall have the tube type number, the JAN prefix, and as many of the other applicable markings as possible placed on the tube with the following order of precedence:

a. Type number

b. JAN prefix

c. Lot identification

d. Manufacturer's identification

e. Manufacturer's factory source code

f. Acceptance date

g. Country of origin

Required marking omitted from the tube for the reasons indicated above, shall be placed on the unit package.

3.6.11 Shelf life. The period of shelf life shall be marked on the tube, package and pack when the shelf life is specified in the TSS (see 4.6.7).

3.7 Workmanship. Tubes acquired to this specification shall be manufactured and processed in a workmanlike manner, in accordance with all applicable provisions. Workmanship shall meet the criteria specified in appendix D.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, 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 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 Classification of inspections. The inspection requirements shall be classified and indicated on the TSS by the groupings specified as follows:

a. General: The "Qualification" requirement, and any exceptions to general provisions of this specification (such as deviation from standard requirements for holding periods, preheating, or preparation for delivery) shall be indicated under this heading.

b. Qualification tests: All tests specified on the TSS are required for qualification approval (QA); however, those tests grouped under this heading on the TSS are to be performed only during qualification inspection (see 4.2).

c. Quality conformance inspection, part 1 (QCI-1): The tests grouped under this heading are made on a lot-sampling basis on a large sample to assure the desired quality of major characteristics which control design parameters and manufacturing processes required for satisfactory performance in general applications. This group may also include visual and dimensional inspection. The TSS may or may not have the sample size and AQL specified; however, the following values shall govern for the subgroupings below:

Electrical: Defects in this subgroup (excluding visual and mechanical and inoperatives) shall be evaluated to the individual AQL specified on the TSS and a combined AQL of 1.0. If the individual AQL is not specified on the TSS, inspect to the AQL indicated below based on lot size.

Lot size	Individual AQL
150 and less	1.0% AQL inspection level II
151 and greater	0.65% AQL inspection level II

Inoperatives: Inoperatives shall be evaluated to a 0.4 AQL combined defectives.

Visual and mechanical inspection: See appendixes C and D.

Dimensions: (See appendix D-30b.) Unless otherwise specified, dimensions shall be inspected at an AQL of 1.0, inspecton level I, for quality conformance inspection, part 1.

d. Quality conformance inspection, part 2 (QCI-2): The tests grouped under this heading are made on a lot-sampling basis on a smaller sample to assure the proper quality of special and environmental characterisitics which control design parameters and manufacturing processes and which are less important or more difficult to perform than those of QCI-1. When the sampling plan is not specified on the TSS, these tests shall be performed at inspection level S3 with an individual AQL of 6.5. Unless otherwise specified, dimensions shall be inspected to an AQL of 6.5, inspection level S3 (see appendix D-30b).

e. Quality conformance inspection, part 3 (QCI-3): The destructive and more time consuming design, degradation-rate tests and life tests are grouped under this heading and are made on a lot-sampling basis on a small sample to assure the proper quality of environmental and life-test characteristics. Unless otherwise specified in the TSS or as modified in the contract or order, the following sampling plan and failure criteria shall be applicable for QCI part 3 special and former periodic check tests (other than life test) such as electrical, environmental, and dimensions: This test(s) shall be performed during the initial production and once each succeeding 12-calendar month period in which there is production. A regular double sampling plan shall be used, with the first sample of three tubes having an acceptance number of zero, and a second sample of three tubes having a combined acceptance number of one. In the event of failure, the test shall be made as a part of quality conformance inspection, part 2, inspection level S3, with an AQL of 6.5. The regular "12 calendar month" double sampling plan shall be reinstated after three consecutive samples have been accepted.

f. First article inspection: For first article inspection procedures, see appendix F.

4.1.2 Testing provisions and inspection conditions (see 3.1). At the discretion of the acquiring activity, any tube whose failure is due to operator error or test equipment malfunction, may not be considered a tube failure. Such tubes may be replaced by randomly selected tubes from the same lot.

4.1.3 Sampling plans. Sampling shall be in accordance with MIL-STD-105 and as specified herein. See definition of "Lot", appendix A, and MIL-STD-105.

4.1.3.1 Lot sizes for tubes listed on generic specification sheets. If sampling plan, test conditions, test limits, and internal construction of tube types covered by a single generic specification sheet are identical, lot sizes for tests referenced on generic TSS's may be combined to determine the sample size for quality conformance inspection, parts 1, 2, and 3 tests. The sample may be composed of either type(s) or combination thereof. Any additional cross-clearance considerations shall be stated on the individual TSS.

4.2 Qualification (see 6.2). Authorization for testing, the testing and the submittal of test reports for qualification shall be in accordance with "Provisions Governing Qualification SD-6" and as specified herein. Each letter requesting authorization and each test report shall refer to only one type, or generic type of tube. In order to obtain qualification approval (QA), all applicable requirements and tests specified herein and on the TSS shall be met. (See 3.1, 4.1.1b, and appendix E.)

4.2.1 Samples and acceptance criteria.

a. The samples for qualification tests shall be representative of the manufacturer's normal production, shall be produced by and at the plant where manufacturing is, or is to be accomplished, and shall be selected from current completely processed production.

b. When not specified in table I, four samples shall be selected with no failures permitted.

c. A bogey tube, if specified, shall be in addition to the sample specified herein and may be a tube that has been stabilized by life-test operation.

d. When more than one tube type is covered by a single TSS (generic specification) and complete qualification testing is being conducted for one of the tube types, only those tests which differ (except heater voltage test condition) need be conducted to obtain qualification for all other types covered by the TSS. In the case of cathode-ray tubes, where more than one phosphor type is shown on a generic TSS, a minimum sample of four tubes of any applicable phosphor or combination of phosphors shall be tested for all requirements; however, only one additional tube need be tested for the other remaining phosphors. This tube shall be tested for phosphor properties only.

e. Failures in excess of those allowed in table I or in 4.2.1b, shall be cause for refusal to grant qualification approval.

4.2.1.1 Marking of samples. The commercial designation may be used instead of the "JAN" prefix marking for qualification test samples. The marking will be inspected for legibility and traceability only.

4.2.2 Test reports. Test report submittals shall be in accordance with 4.2 and the following supplemental information.

4.2.2.1 Description. A description including materials and pertinent design features such as anode, grid, base, filament material, and construction shall be furnished. This need not be detailed to the extent of manufacturing data, but shall be sufficiently complete to define the construction. A second copy of this statement shall be retained by the manufacturer and be available to the Government at the plant. Copies of description forms are available, on request, from the Defense Electronics Supply Center (DESC-EQ).

4.2.2.2 Photographs. Two copies of a photograph of the completely assembled tube and the tube either without envelope but with the assembly cut open, showing complete internal construction, or with the parts unassembled (exploded view) shall be provided. One set of photographs shall be submitted with the report, and one set shall be available to the Government at the plant. The photographs shall be 8 by 10 inches minimum size, depicting the tube on as large a scale as practicable (for T6-1/2 or smaller envelopes, a minimum magnification of 1.5 to 1 is required). The following data shall be included on the photograph: Type number, manufacturer, plant of manufacturer, place of manufacture, and appropriate reference scale (scale placed in the plane of, and parallel to, the centerline of tube parts photographed, and perpendicular to the optical axis of the camera). Radiographs may be used if contributory to description.

*TABLE I. Samples and acceptance criteria for qualification.

Test method if specified herein (3.1.2), or on the TSS			Sample size		Allowable defects	Destructive tests (D) (see 3.1.2.1)
Method or appendix		Title	Applicable paragraph	Number of samples		
1/	Appendix D	Mechanical inspection, dimensions	4.2.1	4	0	---
2/	---	Mechanical resonance (see TSS)	4.2.1	6	0	---
1/	1031	Vibration, low frequency (25 Hz)	4.2.1	4	0	---
	1031	Vibration, variable frequency	4.2.1	4	0	---
	1031	Vibration fatigue	4.2.1	4	1	D
	1041	Shock	4.2.1	10	2	D
	---	Shock (see TSS)	See TSS	See TSS	---	---
1/	1101	Secureness of base, cap, or insert	4.2.1	4	0	---
1/	1105	Permanence of marking	3.6	4	0	---
1/	1111	Base pin solder depth	---	4	0	3/
1/	1116	Lead fatigue (subminiature)	---	5	0	D
1/	1119	Glass-to-lead seal strain	---	6	0	D
	1121	Base strain (miniatures)	---	4/	4/	---
1/	1126	Glass-envelope strain (glass tube)	---	6	0	---
	1202	Filament burnout	---	3	0	D
	1266	Grid emission	---	4	0	---
1/	---	All electrical (not listed in this table)	4.2.1	4	0	---
	---	Life tests	4.6	---	---	---
5/ 6/	1501	Intermittent life	4.2.3	20	See TSS	D
7/	---	Group A life	4.2.3	6	1	D
7/	---	Group B life	4.2.3	4	1	D
7/	---	Group C life	4.2.3	3	1	D
7/ 8/ 9/	---	Group D life	4.2.3	3 (max)	80% avg life	D
7/	---	Group S life (initial)	4.2.3	3	See TSS	D
	1506	Heater-cycling life	4.2.3	10	1	D
	1511	Cathode interface life	---	See TSS	See TSS	D
	1516	Stability life	4.2.3	10	See TSS	---
	2126	Glass strain (receiving tubes)	---	6	0	---
	4223	Mechanical tuning fatigue	4.2.1	2	0	D

1/ Electrical sample may be used for these tests.

2/ Vibration, variable frequency may be used for these tests.

3/ Method 1111 becomes a destructive test if X-ray techniques are not used and additional samples will be required.

4/ Supply the data on 30 tubes from 1 machine making the type. Use acceptance numbers are given in 4.3.2.3.

5/ Low-failure rate tubes: See applicable TSS.

6/ Number of samples indicated applies only when there is no life-test group specified on the TSS.

7/ Regular life-test quality conformance inspection data may be cumulated to supply these data. If this is done, complete data on each lot represented shall be submitted. For dual testing in any one life-test group, half the number of tubes shall be subjected to each test. When the number of tubes is odd, the sample shall be made even by adding one tube.

8/ Life tests are based on degradation of certain characteristics. These characteristics must be within the life-tests end point limits at the completion of 80 percent of the specified life tests. If more than one tube is selected, then acceptance is based on the average life of those tubes tested; however, no tube can be tested for more than the specified life and no more than the specified life hours for any one tube can be credited to the total hours for the purpose of calculating the average hours.

9/ The manufacturer shall select the number of tubes to be tested; however, this number shall be no more than three tubes due to the cost and time consumed during testing.

* 4.2.2.3 Base material. As part of the qualification test report, the tube manufacturer shall identify the base molder or base supplier and shall specify the material used and the value of the insulation zone number obtained. If the qualifying activity disapproves of the base supplier or the insulating material used, it may request a test report be submitted for approval from the base supplier or the tube manufacturer which shall include test data in accordance with test method 1216 of MIL-STD-1311 or to grade L-411 of MIL-I-10 as applicable. A sample size of 6 to 12 with zero defects will be required for these tests.

4.2.3 Life-test data. Complete data on life test, either performed under the cognizance of the Government or certified by the manufacturer as having been performed on production tubes of the same design as the specimens submitted for qualification inspection, shall be included in the test report. The number of samples for which life-test data are required shall be as shown in table I.

4.2.4 Criteria for evaluation of test results. Acceptance will be based on the requirements of table I. The following general rules apply in the event an item is not listed or adequately covered:

a. Electrical tests: No failures shall be permitted.

b. Mechanical (physical) tests: No failures shall be permitted except as shown in table I. Following the mechanical (physical) tests, the samples shall be evaluated for post mechanical (physical) items as listed on the individual TSS.

c. Life tests: The specified AFR, RFR, AQL, or acceptance number shall apply.

4.2.4.1 Prior Government approval. Invitation for bids should provide that the Government reserves the right to waive the requirements for first article samples as to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending acquisition.

* 4.2.5 Retention of qualification. To retain qualification, the suppliers shall forward an executed DD Form 1718 at 24-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. Failure to submit the report within 30 days after the end of each 24-month period, may result in loss of qualification for the product.

* 4.2.5.1 Discontinuance of production. In the event that a manufacturer plans to discontinue production of a tube type or types entirely, the product will remain on the QPL as long as stock remains and the manufacturer notifies the Defense Electronics Supply Center (DESC-EQ) within thirty days after the last product run has been completed. The manufacturer agrees to store overrun from the last production, and when these quantities are exhausted, will notify the qualifying activity to have product listing removed from the QPL.

* 4.3 Quality conformance inspection.

* 4.3.1 Nonconforming lots. A nonconforming lot shall be reworked or retested 100 percent, or both, by the manufacturer prior to resubmitting the lot to quality conformance inspection. If the nonconforming test item is of such a nature as to require rework, the lot shall be subjected to all of QCI, part 1 testing. If the nonconforming test item is of such a nature as to require retest, then the lot shall be tested for those characteristics that were nonconforming.

4.3.2 Base strain test, miniature tube, sampling (method 1121). Tightened inspection shall be in effect initially and shall continue in effect until the criteria specified herein for normal inspection have been met.

4.3.2.1 Normal inspection. The tubes shall be eligible for normal inspection only when all of the following requirements have been met:

a. There has been no change of the tube type on the sealing and exhaust unit during the testing of the last five samples.

b. Not more than a total of eight defects have been found in the last five samples.

c. No rejection has occurred in the last five samples.

4.3.2.2 Sampling. The sample shall consist of 30 tubes selected at random from the production of each sealing-and-exhaust unit. This sample size n = 30, shall be used for both tightened and normal inspection. For normal inspection, the sample shall be selected twice during each regular work shift. For tightened inspection, the sample shall be selected every hour. In either case, the first sample shall be selected at the start of each work shift.

4.3.2.3 Acceptance and rejection criteria. The production lot represented by the sample shall be:

a. Accepted if not more than three defectives for class "A", "B", or "C" defects respectively, or if not more than a total of four defectives are found in the sample (see method 1121).

b. Rejected if four or more defectives for class "A", "B", or "C" defects, respectively, or if a total of five or more defectives are found in the sample.

c. A tube which shows one or more of these defects shall be considered a defective tube for this test.

4.3.2.4 Rejected tubes. If the tubes are rejected on this test, all production from this exhaust unit during the period between the present and previous samples, shall be 100 percent strain-tested for that class of defect which caused rejection. The results of the retest shall be submitted to quality control, and these data shall be used as a basis for acceptance of the rejected lot. These results shall not be used in the cumulative record.

4.3.2.5 Records. A record of all defectives shall be maintained for each sealing-and-exhaust unit. This record shall show the exhaust unit number, the date and time of sample, the number of defectives in each group, the total defectives, and the rejections occurring in the last five samples.

* 4.3.3 Shock test sampling (method 1041). This test shall be conducted on the initial lot and thereafter on a lot approximately every 12 months. When one lot has passed, the 12-month rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lots shall be subjected to this test until a lot passes. MIL-STD-105, sample size code letter E, shall apply.

* 4.3.4 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-E-75.

4.4 Permanence of marking sampling (method 1105). When applicable, method 1105, shall be performed prior to shipment on tubes which have received final processing for marking in compliance with the requirements of 3.6. Sampling shall be as follows:

a. Receiving tubes: Thirteen tubes shall be selected from each marking machine per day and inspected to an AQL of 6.5.

b. Tubes other than receiving types: Quality conformance inspection, part 2, AQL 6.5 at level S3, shall apply.

4.5 Early release from QCI, part 2, tests for a lot accumulated during a period of three weeks or more. The early-release inspection procedures outlined below may be used only while reduced inspection is in effect on the specific tube type. If eligibility for reduced inspection is lost, the early release procedure shall immediately be discontinued and normal-inspection procedure instituted. When eligibility for reduced inspection has been established, the following procedures may be put into effect:

a. While reduced inspection is in effect, tubes may be released on a current basis, that is, shipment need not be withheld pending the test results of quality conformance inspection, part 2.

b. The samples representing the lot may be selected at random either in weekly subsamples, which will accumulate to the required number, or from the production of any single week during the corresponding lot period, at the option of the Government. When samples are selected entirely from production of a single week, a "skip" method of selection shall be utilized. The choice of "sample" weeks shall be staggered in such a manner as to assure a random selection when considered over a period of several months.

c. The test required for acceptance shall be started not later than one week after the complete sample has been selected.

* 4.6 Life testing.

a. Life-test provisions: Life testing shall be conducted as specified herein, except when tubes submitted in accordance with this specification are part of the manufacturer's commercial production, and are life tested by the manufacturer under the specified TSS conditions (or conditions of greater stress), and in at least the required quantities, the acquiring activity may accept the results of these life tests in lieu of the life-test specified herein. Prior to life testing, the manufacturer may subject the tubes to any other TSS tests. If a tube is found to be outside the initial TSS limits or has mechanical defects, it may be replaced by another randomly selected sample from the same lot (see 3.1.2.1).

b. Life-test sampling: The tubes comprising the sample shall be selected at random throughout production in a manner representative of the lot. However, when a manufacturer is in continuous production for an extended period on a particular type, the sample may be selected from the first 10 percent of the production lot. For dual testing in any one life-test group, half the number of tubes shall be tested in each test. When the sample is an odd number of tubes, it shall be made even by adding another tube. The total number of tubes from any one lot subjected to a particular life test shall be considered the life-test sample.

c. Life-test sampling (small lots): A life-test lot shall be a maximum of one-month production, except that a maximum of three month's production of 500 tubes, or less, shall apply to form a single life-test lot (see appendix A for lot definition).

* 4.6.1 Life-test sampling plans.

* 4.6.1.1 Stability life-test sampling (method 1516). Inspection level S3 with an AQL of 1.0 shall be used.

* 4.6.1.2 Intermittent life-test sampling (method 1501).

a. The life-test sample shall consist of 10 tubes per lot and not more than one tube failure shall be permitted. In the event of rejection of the first sample, due to failure of more than one tube, a second sample of 20 tubes shall be selected from the lot. Acceptance shall be based on the combined first and second samples. The total tube failures from the combined first and second samples shall not exceed three.

b. As an alternate method, samples may be selected as specified in 4.6b.

4.6.1.3 Heater cycling life-test sampling (method 1506). Sampling shall start with tightened inspection level S3 and an AQL of 1.0. Conditions in MIL-STD-105 shall be followed to be eligible for normal or reduced sampling. Quality conformance inspection test results accumulated over the preceding 18-month period may be used to establish eligibility for normal or reduced sampling. (The provisions of 4.9 do not apply.)

* 4.6.1.4 Group A, life-test sampling plan (see 4.6c). The number of tubes to be tested per lot shall be in accordance with table II.

TABLE II. Group A, double sampling plan. 1/

Sample	Sample size (n)	Cumulative sample size	Acceptance number (C)	Rejection number
First	5	5	1	4 (or 3 inoperatives)
Second	10	15	3 (2 or less inoperatives)	4 (or 3 inoperatives)

1/ The sampling plan applies at the end of the specified life-test period.

* 4.6.1.5 Group B, life-test sampling plan (see 4.6c). The number of tubes to be tested per lot shall be in accordance with table III.

TABLE III. Group B, double sampling plan. 1/

Sample	Sample size (n)	Cumulative sample size	Acceptance 2/ number (C)
First	3	3	0
Second	3	6	1

1/ The sampling plan applies at the end of the specified life-test period.
2/ C1 = 1 if the first sample from the preceding lot contained zero defectives.

* 4.6.1.6 Group C, life-test sampling plan (see 4.6c). The number of tubes to be tested shall be in accordance with table IV.

TABLE IV. Double sampling plan. 1/

Lot size (N)	Sample	Sample size (n)	Cumulative sample size	Acceptance number (C)
25 or less	First	1	1	0
26 to 250	First	2	2	2/ 4/ 0
	Second	2	4	1
251 or more	First	4	4	3/ 4/ 1
	Second	4	8	2

1/ The sampling plan applies at the end of the specified life-test period.
2/ C = 1 if the first sample from the preceding lot contained 0 defectives.
3/ C = 2 if the first sample from the preceding lot contained 0 defectives.
4/ Footnotes 2 and 3 apply only if the preceding lot was manufactured during the last six months.

* 4.6.1.7 Group D, life-test sampling plan (see 4.6c). The number of tubes to be life tested shall be one percent of each month's production, but not less than one nor more than three tubes per month shall be tested. At the option of the manufacturer, additional tubes in any quantity considered necessary to represent more accurate statistical sampling of the lot may initially be subjected to all tests required and failure data shall be based on the total number of tubes placed on test. After the life test has started, the manufacturer may add an additional quantity of tubes to the initial life-test sample, but this may be done only once for any life-test lot. The average life of the sample shall be calculated as follows:

a. If the tube successfully completes the number of hours specified, the number of credit hours shall be considered equal to the specified duration of the test.

b. If the time of failure of a tube was determined exactly, the number of credit hours shall be equal to the number of hours on life completed before failure.

c. If the time of failure of a tube cannot be determined exactly, the number of credit hours shall be either the number of hours up to the last successful reading plus 10 percent of the specified life, or the number of hours up to a time midway between the last successful and the first unsuccessful reading, whichever is less.

The average life of the sample shall be the average of the hours credited to the individual tubes in that sample. Unless otherwise specified, at the conclusion of the time specified for the life test, the average life of the sample shall be not less than 80 percent of the duration of the test.

4.6.1.8 Group S, life-test sampling plan. This group is applicable when the mean life of the tube is of prime interest, rather than the failure rate in early life. Group S life test consists of three parts: Initial life test (see 4.6.1.8.1), to be completed before any delivery is made; multiple short-life test (see 4.6.1.8.2) which determines the acceptability of each lot; and sequential life test (see 4.6.1.8.3) which provides information on the ultimate capability of the tube, and stops shipments of the tube in the event of a significant deterioration in life, but is not related to any particular lot.

4.6.1.8.1 Initial life test. This is a destructive test. Three tubes shall be life tested under the specified conditions. The average life of the sample shall be not less than the specified life, and no tube shall fail at less than half the specified life. Specified life is to be interpreted as the life test duration specified on the TSS. The life to be credited to each tube shall be determined in accordance with 4.6.1.7b and c.

4.6.1.8.1.1 Initial life test waiver. The credit hours for any one tube are not limited to the specified life. This test shall be waived if the manufacturer has successfully completed qualification life tests for the tube type, or if the current production run follows within 12 months a successful earlier run, and no significant change in design or production has been made. The test shall be completed (or waived) before any delivery of tubes is made.

4.6.1.8.2 Multiple short-life test. Tubes shall be selected from current production according to the double sampling specified below, and placed on life test for a period equal to 10 percent of the specified life, but not less than 24 hours or more than 100 hours each. At the end of this period, those parameters listed under life-test end points shall be measured, but the limit values shall be the initial test limits. Passing this test indicates the lot from which the tubes were drawn is acceptable unless shipments have been halted in accordance with 4.6.1.8.3. This test is nondestructive except for any tube which fails to pass. Tubes which pass shall be returned to the lot from which they were drawn. The sample size and acceptance and rejection numbers depend on the lot size.

Lot size (N)	Sample size (n)	Acceptance number (C)	
under 10	$n_1 = 1$ n_2 = remainder of lot	$C_1 = 0$ $C_2 = 1$	
10 to 50	$n_1 = 5$ $n_2 = 5$	$C_1 = 0$ $C_2 = 1$	except $C_1 = 1$ and $C_2 = 2$ if there was no failure in the previous first sample.
51 to 250	$n_1 = 7$ $n_2 = 7$	$C_1 = 0$ $C_2 = 1$	
251 and up	$n_1 = 10$ $n_2 = 10$	$C_1 = 1$ $C_2 = 2$	

This test shall be run concurrently with production. Prerelease may be allowed when there was no failure on this test in the previous lot and there has been no failure so far during the current period.

4.6.1.8.3 Sequential life test. This is a destructive test. The number of sequential life-test sockets is determined by the monthly rate of production (MRP) as follows:

MRP	Sockets
Up to 250	1
251 to 500	2
501 and up	3

The specified sockets shall be filled with tubes from the first lots. Tubes shall be selected in a random manner from those which have met the requirements of the multiple short-life test. Each tube shall be operated at the specified life-test conditions until it fails to meet one or more of the life-test end points (end-of-life values). It shall then be replaced with a tube drawn from current production. It shall also be replaced if it reaches two and one-half times the specified life; a tube removed under this clause shall be plotted as specified in figure 1 as though it had failed at that time. Credit hours shall be determined as specified in 4.6.1.7b and c. The time spent on multiple short-life test shall not be included. The results of this test shall be plotted. Plot as ordinate the ratio of aggregate hours T to specified life t; this axis then represents the number of "nominal tube life times." The number of failures (including tubes taken off at two and one-half times the specified life), denoted by K, is plotted as abscissa (see figure 1). The reject line shall be defined by:

$$K = 1.25 \frac{T}{t}$$

The area below the reject line is denoted as zone A. There shall also be a line plotted as defined by:

$$K' = \frac{T}{t} - 1.64 \sqrt{\frac{T}{t}}$$

The area above this line is denoted as zone C. The area between zone C and the reject line is denoted as zone B. Initial life-test credit hours (including rerun initial life tests following a rejection on this test) are never included in the sequential life-test plot. The plot shall be brought up-to-date when any failure occurs, and may be updated more frequently at the manufacturer's option. A convenient interval is the same as is used for checking the tube(s) on test for conformity to the end-of-life parameters. Aggregate life T includes the accumulated hours on all tubes, running or failed, except those excluded under replotting rules specified herein. The "head" of the plot moves along a vertical line as long as hours are being accumulated without failure, and moves one unit horizontally to the right each time a failure occurs. In the event that the plotted "staircase" enters zone A, shipments shall be halted, and the cause of deterioration shall be investigated.

Shipments may be resumed either on satisfactory evidence that the cause has been found and corrected, or on successfully rerunning the initial life test (without waivers). When shipments are resumed, the sequential life-test plot is started over at zero. As long as the plotted "staircase" remains in zone B or C, shipment of lots acceptable under 4.6.1.8.2 is continued. In the event that the plotted staircase enters zone C, there is high confidence that the product is better than the specified life. When the initial life test (see 4.6.1.8.1) is waived, shipments shall not be made before the aggregate hours on the sequential life-test sockets show a combined average equal to 80 percent of the specified life. After nine months or 10 failures, whichever occurs first, the data shall be replotted. The origin of coordinates shall be moved up to the starting point of either the vertical line on which the chart stood six months before, or of the fifth tube back, as the case may be.

4.6.1.8.3.1 Continuance of sequential life test. The reject line moves up with the coordinate axes. The chart then shows data on the last six months or five tubes. Data continue to be added to the new chart until it again reaches either nine months or 10 tubes, when the replotting cycle is repeated. When the tubes contracted for are built in a shorter period than the specified life, the sequential life test shall be continued after production is complete, until the aggregate hours on each socket are at least equal to the specified life. A rejection in this "post production" period shall preclude any waiver of 4.6.1.8.1 for the next production run of the same tube type. In other cases, the sequential life test shall be terminated when the multiple short-life test on the final lot of tubes is completed.

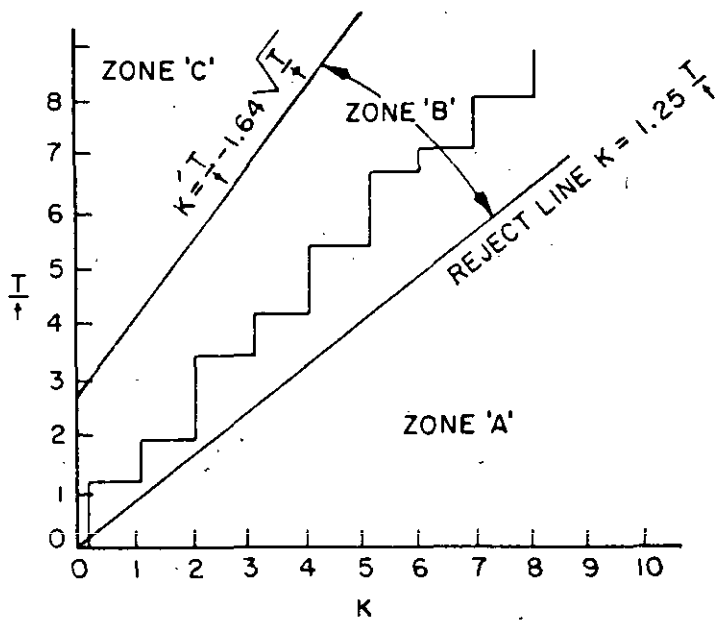


FIGURE 1. Group S-Sequential life-test plot (illustrative).

4.6.2 Life-test end points. The duration of life tests and tests required during and at end-of-life tests, shall be as specified on the TSS (and indicated below for cathode-ray tubes). The end-point tests shall be conducted at intervals during or at the end of the life test period. Time between intervals shall be determined by the manufacturer. A tube shall be considered defective when it fails to be within the specified life test end-point limits when measured under the conditions specified. In addition, when the TSS specifies methods 1201 and 1267, a tube which becomes inoperative due to a permanent short, discontinuity, or air leak shall be considered defective. When two or more tests are specified for end points, failure of any shall constitute failure of the tube. When optional tests are specified on the TSS, the one selected by the manufacturer at the start of the life test shall govern.

4.6.2.1 Cathode-ray tubes. In addition to the requirements of 4.6.2, cathode-ray tubes shall not exceed the following limits at the end of the specified life test:

Heater-cathode leakage	30 µAdc
Grid No. 1 leakage	5 µAdc
Grid No. 2 leakage	15 µAdc
Anode No. 1 leakage	15 µAdc
Anode No. 2 leakage	15 µAdc
Stray emission	See method 5216

4.6.3 Prerelease provisions groups A, B, C, and D life test. Prerelease provisions for groups A, B, C, and D life tests shall be as follows:

a. The procedures applicable to the various life-test groups shall be as specified below and in 4.6.4:

Group	Paragraph
A	4.6.3.1
B	4.6.3.2
C	4.6.3.3
D	4.6.3.4

b. The Government may, by contractual provisions, release tube lots for shipment prior to completion of life test if eligibility for prerelease has been established. In those cases where there has been a production discontinuity of both military and commercial production for a period in excess of 12 months, eligibility for prerelease shall be reestablished. In no case shall prerelease shipment be made without contractual provision and approval. When tube types submitted under this specification are part of the manufacturer's commercial production and are tested by the manufacturer under the life-test conditions specified herein, or under conditions of greater stress, and in the required quantities the results of these tests may be used to establish eligibility for prerelease of such types.

4.6.3.1 Group A, establishment of prerelease eligibility. The minimum number of first sample tubes only shall have completed the specified life-test duration before the prerelease plan can be used. To more rapidly establish eligibility for prereleasing, larger life-test samples may be selected from initial life-test lots in accordance with the following:

a. The number of tubes from any lot shall not exceed 10.

b. In those cases where more than five tubes are selected, the tubes shall be sequentially numbered and the first five tubes shall be considered the first sample for evaluation of the lot they represent.

4.6.3.1.1 Prerelease provisions. A lot is eligible for shipment prior to completion of life test if the sampling test results meet the requirements in table V.

TABLE V. Group A, prerelease requirements.

Criteria for prerelease	Tube sample	Allowable number defectives at: 1/ 10% of specified life	30% of specified life	60% of specified life	100% of specified life
10% of specified life	Current 5	0	---	---	---
	Last 30	1	2	3	5
30% of specified life	Current 5	---	0	---	---
	Last 30	---	3	4	5
60% of specified life	Current 5	---	---	1	---
	Last 30	---	---	4	5

1/ Table V shall be interpreted as follows:

Prerelease period	Criteria for prerelease
10 percent of specified life - - - - -	1. The 5-tube sample from the lot being evaluated shall contain 0 defectives at 10 percent of the specified life-test duration; and 2. The last 30 tubes which have completed 10 percent of the specified life-test duration shall contain not more than 1 defective; and 3. The last 30 tubes which have completed 30 percent of the specified life-test duration shall contain not more than 2 defectives (cumulatively); and 4. The last 30 tubes which have completed 60 percent of the specified life-test duration shall contain not more than 3 defectives (cumulatively); and 5. The last 30 tubes which have completed 100 percent of the specified life-test duration shall contain not more than 5 defectives (cumulatively).
30 percent of specified life - - - - -	1. The 5-tube sample from the lot being evaluated shall contain 0 defectives at 30 percent of the specified life-test duration; and 2. The last 30 tubes which have completed 30 percent of the specified life-test duration shall contain not more than 3 defectives (cumulatively); and 3. The last 30 tubes which have completed 60 percent of the specified life-test duration shall contain not more than 4 defectives (cumulatively); and 4. The last 30 tubes which have completed 100 percent of the specified life-test duration shall contain not more than 5 defectives (cumulatively).
60 percent of specified life - - - - -	1. The 5-tube sample from the lot being evaluated shall contain not more than 1 defective (cumulatively) at 60 percent of the specified life-test duration; and 2. The last 30 tubes which have completed 60 percent of the specified life-test duration shall contain not more than 4 defectives (cumulatively); and 3. The last 30 tubes which have completed 100 percent of the specified life-test duration shall contain not more than 5 defectives (cumulatively).

4.6.3.1.1.1 Additional prerelease provisions. In addition to the prerelease reading periods shown in table V, readings may be taken on sample tubes 24 hours prior to or 72 hours subsequent to the prerelease period and may be considered as having been read at the prerelease period; however, the full 10 percent of the specified life-test duration shall be completed prior to release at the 10 percent prerelease period.

4.6.3.1.2 Exceptional life history. In those cases where a tube type shows exceptionally good life history, as determined by compliance with conditions a and b, interim readings at 30 and 60 percent of specified life may be discontinued, at the option of the manufacturer, and the lot may be released at 10 percent of specified life.

a. The five-tube sample from the lot being evaluated shall contain zero defectives at 10 percent of specified life.

b. The last 30 tubes which have completed 100 percent of the specified life-test duration shall contain not more than one defective.

4.6.3.1.2.1 Defectives at 10 percent of specified life. When defectives occur at 10 percent of specified life, which make it mathematically impossible for the tube type to meet the 100 percent of specified life criterion in 4.6.3.1.2b, prerelease procedures shall revert to those specified in 4.6.3.1.1.

4.6.3.2 Group B, establishment of prerelease eligibility. A minimum of 12 tubes shall have completed the specified life-test duration before the prerelease plan can be used. At the option of the manufacturer, to more rapidly establish eligibility for prereleasing, larger life-test samples may be selected from life-test lots in accordance with the following:

a. The number of tubes from any one lot shall not exceed six.

b. In those cases where more than three tubes are selected, the tubes shall be sequentially numbered and the first three tubes shall be considered the first sample for evaluation of the lot they represent; the second three tubes shall be considered as the second sample, when required.

4.6.3.2.1 Prerelease provisions. A lot is eligible for shipment prior to completion of life-test if the sampling test results meet the requirements in table VI.

TABLE VI. Group B, prerelease requirements.

Criteria for prerelease at:	Tube sample	Allowable number of defectives 1/
10% of specified life	Current 3 Last 18	0 0
30% of specified life	Current 3 Last 18	0 2
60% of specified life	Current 3 Last 18	0 3

1/ The requirements of this tabulation are applicable to first sample only. Table VI shall be interpreted as follows:

Prerelease period	Criteria for prerelease
10 percent of specified life - - - - -	1. The 3-tube sample from the lot being evaluated shall contain 0 defectives at 10 percent of the specified life-test duration; and 2. The last 18 tubes which have started life-test shall contain 0 defectives at their present life-test status at the time of prerelease of the current lot.
30 percent of specified life - - - - -	1. The 3-tube sample from the lot being evaluated shall contain 0 defectives at 30 percent of the specified life-test duration; and 2. The last 18 tubes which have started life-test shall contain not more than 2 defectives at their present life-test status at the time of prerelease of the current lot; and

Prerelease period	Criteria for prerelease
30 percent of specified life - - - - - - Continued	3. That portion of the last 18 tubes which have started but have not completed life-test shall contain not more than 1 defective at the time of prerelease of the current lot.
60 percent of specified life - - - - - -	1. The 3-tube sample from the lot being evaluated shall contain 0 defectives at 60 percent of the specified life-test duration; and 2. The last 18 tubes which have started life test shall contain not more than 3 defectives at their present life-test status at the time of prerelease of the current lot; and 3. That portion of the last 18 tubes which have started but have not completed life test shall contain not more than 1 defective at the time of prerelease of the current lot.

4.6.3.3 Group C, establishment of prerelease eligibility. A minimum of 16 tubes shall have completed the specified life-test duration before the prerelease plan can be used. At the option of the manufacturer, to more rapidly establish eligibility for prereleasing, larger life-test samples may be selected from life-test lots in accordance with the following:

a. The number of tubes from any one lot shall not exceed eight.

b. In those cases where more than four tubes are selected, the tubes shall be sequentially numbered and the first four tubes shall be considered the first sample for evaluation of the lot they represent; the second four tubes shall be considered as the second sample, when required.

4.6.3.3.1 Prerelease provisions. A lot is eligible for shipment prior to completion of life test if the sampling test results meet the requirements in table VII.

TABLE VII. Group C, prerelease requirements.

Criteria for prerelease at:	Tube sample	Allowable number of defectives 1/
10% of specified life	Current 4 Last 16	0 1
30% of specified life	Current 4 Last 16	0 2
60% of specified life	Current 4 Last 16	1 3

1/ The requirements of this tabulation are applicable to first sample only. Table VII shall be interpreted as follows:

Prerelease period	Criteria for prerelease
10 percent of specified life - - - - -	1. The 4-tube sample from the lot being evaluated shall contain 0 defectives at 10 percent of the specified life-test duration; and 2. The last 16 tubes which have started or completed life test shall contain not more than 1 defective at their present life-test status at the time of prerelease of the current lot; and 3. That portion of the last 16 tubes which have started but have not completed life test shall contain 0 defectives at the time of prerelease of the current lot.
30 percent of specified life - - - - -	1. The 4-tube sample from the lot being evaluated shall contain 0 defectives at 30 percent of the specified life-test duration; and 2. The last 16 tubes which have started or completed life test shall contain not more than 2 defectives at their present life-test status at the time of prerelease of the current lot; and 3. That portion of the last 16 tubes which have started but have not completed life test shall contain not more than 1 defective at the time of prerelease of the current lot.
60 percent of specified life - - - - -	1. The 4-tube sample from the lot being evaluated shall contain not more than 1 defective at 60 percent of the specified life-test duration; and 2. The last 16 tubes which have started or completed life test shall contain not more than 3 defectives at their present life-test status at the time of prerelease of the current lot; and 3. That portion of the last 16 tubes which have started but have not completed life test shall contain not more than 1 defective at the time of prerelease of the current lot.

4.6.3.4 Group D, prerelease provisions. A lot is eligible for shipment prior to completion of life test if the completed life-test samples immediately preceding the current samples meet the requirements listed below, and the current uncompleted life-test samples shall not have failed at this time. An uncompleted life-test sample shall be considered unsatisfactory for prerelease if it is mathematically impossible for it to be acceptable in accordance with 4.6.1.7 when considering only those tubes which are initially subjected to life test.

Prerelease period	Criteria for prerelease
10 percent of specified life - - - - -	1. If the last seven completed samples passed; or 2. If not more than 1 of the last 17 completed samples failed.
30 percent of specified life - - - - -	1. If the last five completed samples passed; or 2. If not more than 1 of the last 14 completed samples failed.

Prerelease period	Criteria for prerelease
60 percent of specified life - - - - -	1. If the last three completed samples passed; or 2. If not more than 1 of the last 10 completed samples failed.
80 percent of specified life - - - - -	None

4.6.4 Failure after shipment, groups A, B, C, and D life tests. If a life-test sample fails and the lot represented has been shipped prior to completion of life test, the manufacturer shall immediately notify the cognizant government inspector and the contracting officer of the failure, and of action taken.

4.6.5 Nonconforming lots. If additional electrical processing is performed on tubes to repair a defect, an additional life-test sample shall be selected from the nonconforming lot. Nonconforming (resubmitted) lots shall be as defined in MIL-STD-105.

4.6.6 Service-life guarantee. When service-life guarantee is specified on the TSS, or in the contract or order (see 6.1), the tube shall not be subjected to the life test but shall have a service-life guarantee. The period of this service-life guarantee shall be as specified on the TSS, subject to modification in the contract or order.

4.6.7 Shelf life. In general, electron tubes have an indefinite shelf life; however, where specific shelf life has been determined and is specified in the TSS, the marking shall be as specified in 3.6.11.

4.7 Testing and marking at remote locations. The following criteria shall govern acceptance and marking of tubes at locations other than at the point of manufacture.

a. When tubes are manufactured and tested at one plant and marked at another location, inoperative tests shall be performed at the marking location, in accordance with the applicable quality conformance inspection procedure, prior to preparation for shipment.

b. When tubes are manufactured at one plant, but transported to another location for production testing and marking, all quality conformance inspection, part 1, tests shall be performed at the marking point in accordance with the applicable quality conformance inspection procedure prior to marking. All other tests specified are made at the point of manufacture.

4.8 Delayed shipment of inspected tubes.

* 4.8.1 Tube manufacturer's facilities. The following criteria shall govern the acceptance of inspected tubes which have been held in storage within the manufacturer's facilities:

a. Tubes which have passed inspection and have subsequently been held in storage for a period of six months but less than 12 months, shall be retested for inoperative defects, in accordance with the applicable quality conformance inspection procedure, prior to marking and shipping.

b. Tubes which have passed inspection and have subsequently been held in storage for a period of 12 months or longer, shall be retested for inoperatives and all other quality conformance inspection, part 1, tests in accordance with the applicable quality conformance inspection procedure, prior to marking and shipping.

c. The following alternate procedure may be implemented at the discretion of the manufacturer after five successive lots have passed 4.8.1a:

Tubes which have passed inspection and have subsequently been held in storage for a period of six months or longer, shall be retested for inoperative defects, in accordance with the applicable quality conformance inspection procedure, prior to marking and shipping. If, during retest, a lot fails for inoperatives, 4.8.1a must be applied until five successive lots have passed the inoperative inspection. In addition to the inoperative inspection, when product has been in storage for six months or longer, such product shall be retested for all quality conformance inspection, part 1, tests in accordance with the applicable quality conformance inspection procedure, prior to marking and shipping.

* 4.8.2 Other than the tube manufacturer's facilities. The following criteria shall govern the acceptance of inspected tubes which have been held in storage at other than the manufacturer's facilities:

a. Tubes which have passed inspection and have been held in storage for a period of six months but less than 12 months, shall be retested for inoperative defects by the supplier, using test facilities that are acceptable to the Government, in accordance with the applicable quality conformance inspection procedures.

b. Tubes which have passed inspection and have been held in storage for a period of 12 months, or longer, shall be retested for inoperatives and all other quality conformance inspection, part 1, tests by the supplier, using test facilities that are acceptable to the Government, in accordance with the applicable quality conformance inspection procedure.

c. Acceptable tubes resulting from the procedures of either 4.8.2a or 4.8.2b shall be additionally marked with the reinspection date in accordance with the requirements of 3.6.6, prior to shipping to the Government or its contractor(s).

d. When the lot has lost its identity, or the storage time is not known, the tubes shall be 100 percent inspected for compliance with quality conformance inspection, part 1.

* 4.9 Irregular production. When production is intermittent or irregular (charaterized by lapses of a three-month duration or longer), either normal or tightened inspection shall be used, depending on the eligibility of the manufacturer. The Government may authorize reduced inspection for quality conformance inspection, part 2 tests after the first lot, if all of the following conditions are met:

a. The lapse of time is less than six months.

b. The manufacturer was eligible for reduced inspection at the end of the previous production run.

c. Eligibility for reduced inspection is maintained.

4.10 Rejected lots. If an inspection lot is rejected, the supplier may rework it to correct the defects, or screen out the defective units, and resubmit for re-inspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots by the manufacturer's lot records.

4.11 Disposition of sample units.

a. Sample units which have passed all the nondestructive tests may be delivered on the contract or purchase order, if the lot is accepted and the sample units are still within the specified tolerances.

b. Sample units which have been subjected to destructive tests shall not be delivered on the contract or purchase order.

c. Any tube known to have failed the provisions of either MIL-E-1, MIL-STD-1311, or sample tubes which do not meet the initial limits after nondestructive life tests, shall not be delivered on the contract or purchase order.

* 4.12 First article inspection. First article inspection, when specified, shall be in accordance with appendix F.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-E-75.

6. NOTES

6.1 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Title, number, and date of the applicable tube specification sheet, and the type designation.

c. Service-life guarantee in lieu of life test when applicable (see 3.6.9 and 4.6.6).

6.2 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification.

The activity responsible for the qualified products list is the Naval Electronic Systems Command, Department of the Navy, Washington, D.C. 20363; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-EQ), 1507 Wilmington Pike, Dayton, Ohio 45444. (See 4.2.)

* 6.2.1 First article. When a first article inspection is required, the item will be tested and should be representative of the product to be produced for delivery on the contract or purchase order. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, test approval of the documents first article (see appendix F).

6.3 Service uses. Equipment using tubes manufactured in accordance with this specification should be designed so that the tubes perform satisfactorily in the normal service for which the equipment is designed. The use of characteristics not controlled by this specification is not permitted unless the command or service concerned has specifically approved such use.

6.4 Absolute ratings. The values specified on the TSS under "maximum" or "minimum" are based on the "absolute system" and are not to be exceeded under any service conditions. These ratings are limiting values outside which the serviceability of any individual tube may be impaired. In order not to exceed absolute ratings, the designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by a safety factor so that the absolute values will never be exceeded under any usual conditions of supply-voltage variation, load variation, or manufacturing variations in the equipment itself. It does not necessarily follow that combination of absolute maximum ratings can be attained simultaneously. The maximum and minimum ratings designate the maximum or minimum of the absolute value of that rating regardless of polarity.

6.4.1 Barometric pressure (altitude) rating. In the event that the specified rating is exceeded, reduction of instantaneous voltages (excluding filament or heater voltage) may be required.

6.4.2 Receiving tube ratings. Receiving tube ratings specified on the TSS are absolute maximum values for an individual tube, and equipment should be designed with this fact in mind. However, these ratings may be exceeded only as indicated in 6.4.2.1 and 6.4.2.2 without appreciable deterioration in tube life.

6.4.2.1 Anode voltage. Unless otherwise specified, the average anode voltage (averaging time 0.1 second) should not exceed the maximum rated dc anode voltage; and the peak positive anode voltage should not exceed twice the maximum rated dc anode voltage.

6.4.2.2 Screen voltage. The maximum screen voltage may be exceeded when all of the following conditions are met:

a. The screen voltage does not exceed the dc anode voltage rating under any operating conditions.

b. The anode voltage rating is greater than the screen voltage rating.

c. The average screen dissipation does not exceed values given by the following formula:

$$P_{g2} \leq P_{g2}\ (\text{max rating}) \left[1 - \left(\frac{Ec2 - Ec2\ (\text{max rating})}{Eb(\text{max rating}) - Ec2(\text{max rating})}\right)^2\right]$$

This formula applies when the average screen voltage is between the maximum rated dc screen voltage and the maximum rated dc anode voltage.

6.4.2.3 Reduced pressure (altitude) rating. This rating is applicable to all subminiature, miniature, and other wafer (button) header receiving tube types except high-voltage rectifiers and is based on the minimum pin or lead spacings specified on these types. It does not take into account the effects of tube sockets, any other terminating devices, and any environmental effects, such as radiation, which may exist simultaneously at any altitude. Figure 2 specifies the maximum rating of the instantaneous voltage between adjacent pins as a function of air pressure. Table VIII indicates an altitude/pressure cross-reference.

NOTE: For operation at any pressure (altitude), the maximum-instantaneous voltage between any adjacent pins is limited in accordance with the rating in figure 2. The equipment designer is cautioned to consider that voltage breakdown is only one factor influenced by altitude, and that other tube ratings, especially temperature, must also be observed. If instantaneous operating voltages not exceeding 280 volts are used between adjacent pins, these types will not have to be derated for altitude effects.

TABLE VIII. Altitude/pressure conversion.

ALTITUDE (x 1,000 ft)	PRESSURE Torr (mmHg)
50	87.49
55	68.88
60	54.24
70	33.66
80	21.01
90	13.21
100	8.36
110	5.33
120	3.45
130	2.27
140	1.51
150	1.02
160	0.697
170	0.478
180	0.326
190	0.221
200	0.148

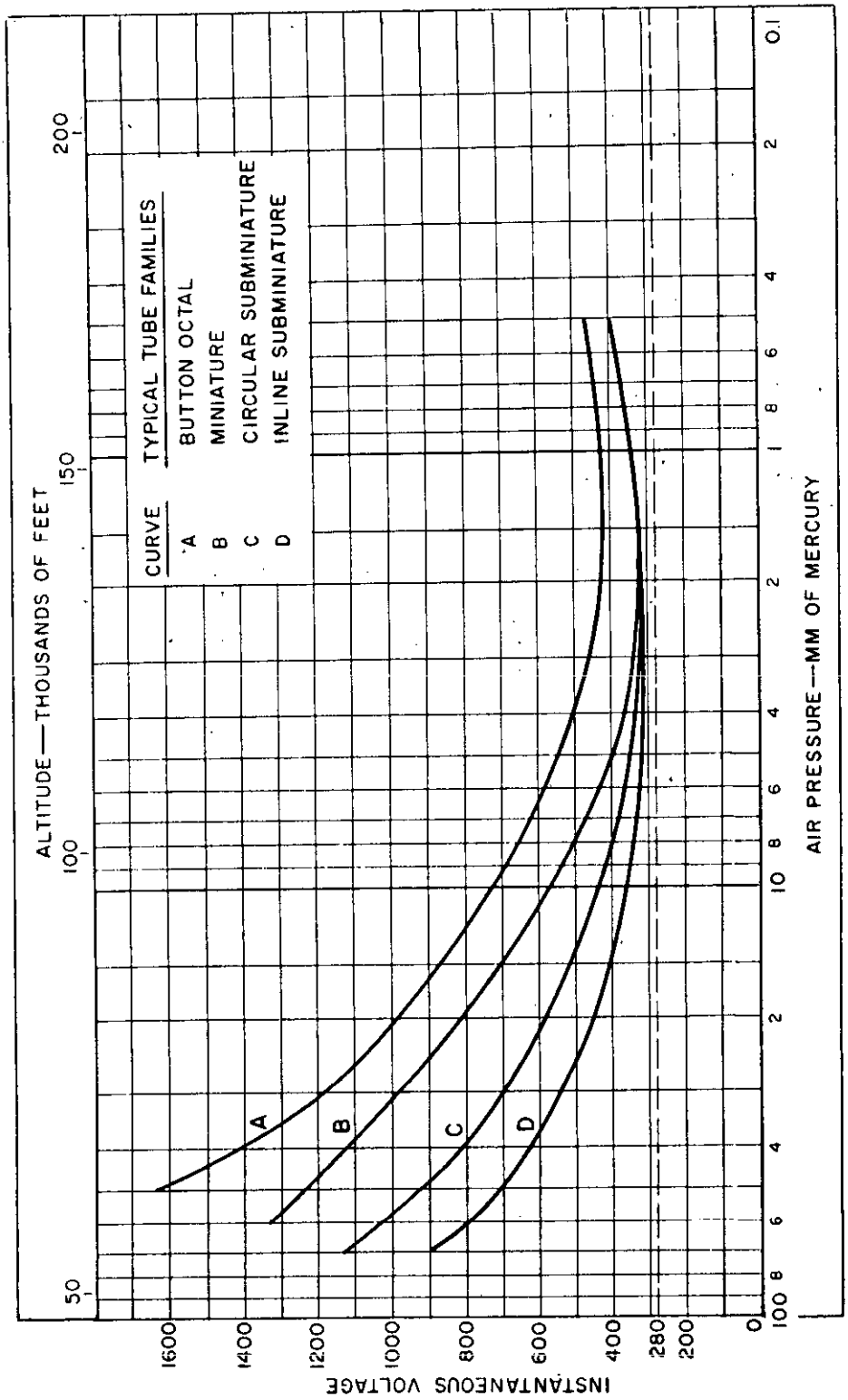


FIGURE 2. Reduced pressure (altitude) voltage breakdown characteristics.

* 6.5 International standardization agreements. Certain provisions of this specification are subject to International Standardization Agreement (STANAG No. 4012, 4093, and 4107). When amendment, revision, or cancellation of this specification is proposed, which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

6.6 Designation of TSS changes. The margins of revised specification sheets shall be marked with a revision letter, within a circle, to indicate where changes from the previous issue were made. This is done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of the specification sheets based on the entire content irrespective of the marginal notations and relationship to the last previous issue. (See appendix B.)

6.7 Changes from previous issue. The margins of this specification are marked with asterisks (*) to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This is done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

DEFINITIONS OF TERMS

10. SCOPE

10.1 Scope. The terms and definitions used in this specification are in accordance with American National Standards Institute C60.9, MIL-STD-105, and MIL-STD-109. This appendix contains supplementary terms used in this specification and MIL-STD-1311, with definitions listed alphabetically in 30. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

20.1 Government standard. Unless otherwise specified, the following standard of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this appendix to the extent specified herein.

STANDARD

MILITARY

MIL-STD-109 - Inspection Terms and Definitions.

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

* 20.2 Industry publications. The latest revisions of the following documents form a part of this appendix to the extent specified herein.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

RS-209 *Electron Devices.*

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, N.W. Washington, D.C. 20006.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/IEEE161-1971 - Terms for Electron Tubes.

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, New York 10018.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

20.3 Order of precedence. In the event of a conflict between the text of this appendix and the references cited herein, the text of this appendix shall take precedence.

* 30. TERMINOLOGY

Acceleration. A vector quantity that specifies the time rate of change of velocity. Acceleration is measured from zero to peak and expressed in multiples of G.

Acceptance failure rate. The maximum failure rate that, for purposes of sampling of electron tubes, may be considered satisfactory as a process average. (Analogous to AQL in acceptance sampling.)

Amplification factor (Mu) (μ). For vacuum tubes, the ratio of a small change in anode voltage to the corresponding change in grid voltage required to produce the same change in anode current (all other electrode voltages and currents being held constant).

Low μ	Less than 10
Medium μ	10 to less than 50
High μ	50 and above

Applied potential. The applied potential on an electrode is the potential between the electrode and the reference point.

Anode delay time (tad). A time interval between the point on the rising portion of the grid pulse which is 25 percent of the maximum unloaded pulse amplitude and the point where anode conduction takes place.

Bogey value. The bogey value is a design value or objective. For asymmetrically distributed characteristics the bogey value is not the center value of the limits; it is a manufacturing objective about which the actual values will be distributed.

Control defect. A control defect is one which constitutes deviation from good workmanship or applicable specification, but which has no effect on the functioning, assembly, maintenance, and life of the unit in service.

Decade. The interval between any two frequencies having a ratio of 10:1.

Discontinuity. A discontinuity is a lack of continuity in any circuit.

Displacement. A vector quantity that specifies the change of position of a body or particle. In this specification displacement is expressed as the total excursion measured in millimeters or in inches; for example, 0.080 inch 0.080 mm.

G. The acceleration produced by the force of gravity, which varies with the latitude and elevation of the point of observation. By international agreement the value 980.665 cm per sec^2 = 386.087 in. per sec^2 = 32.1739 ft per sec^2 has been chosen as the standard acceleration due to gravity.

Generic specification sheet. A generic specification sheet is a TSS indicating requirements and tests for two or more tube types which, except for limited variations in physical electrical characteristics that can be uniquely specified on a single TSS, are identical in design, manufacture, and application. Examples include cathode-ray tubes with different phosphors, receiving tubes with different filament or heater voltages, and klystrons with different operating frequencies.

Ignitor. A insulated electrode (often called a "keep-alive" or "primer") designed to maintain a dc glow discharge in a gas-switching tube.

Inoperatives. Inoperatives are shorts, discontinuities, and air leaks. (Methods 1201 and 1267.)

Limits. The term "within the limits specified" includes the limit values shown on the tube specification sheet.

Lot. A manufacturing or inspection lot shall be defined as a group of fully processed tubes of one type which are manufactured under essentially the same conditions with respect to material, construction, and processing during a maximum period of 14 consecutive calendar days. If the production rate is 2000 tubes or less for this period, the production of up to two calendar or fiscal months may be combined to make up one lot of 8000 tubes or less. If the production rate for a three month period is 500 tubes or less, 500 tubes or less may be accumulated from production extending over a maximum period of three months to form a single lot.

Major cross section. The major cross section of a tube is the first of the following which is applicable:

a. As defined on the tube specification sheet.

b. The plane of the deflecting electrodes farthest from the base of electrostatic cathode-ray tubes.

c. The plane of the heater pins of metal tubes or shielded glass tubes and symmetrically constructed tubes.

d. The plane of the number one grid side rods.

e. Any plane through the axis of the tube of perfectly symmetrically constructed tubes.

Microwave tubes. Tubes utilizing principles of operation that are normally employed at frequencies above one gigahertz, or tubes using distributed rather than lumped circuit elements.

Miniature tubes. Tubes with shape and dimensions designated in EIA Standard RS-209-A as T5-1/2 and T6-1/2 (round) envelope configuration and rigid pins.

Octave. The interval between any two frequencies having a ratio of 2:1.

Peak forward anode voltage. The peak forward anode voltage is the maximum voltage applied to the anode with respect to the cathode in the forward direction.

Peak inverse anode voltage. The peak inverse anode voltage is the maximum voltage applied to the anode with respect to the cathode in the inverse direction.

Permanent short. A permanent short is a short circuit which exists for an appreciable time when there is no accelerating force applied to the tube. This class includes sustained short circuits which may be cleared by subsequent acceleration.

Polarity. All potentials are designated by polarity with respect to the reference point.

Power or transmitting tubes. Tubes so designated by the TSS. These are negative grid tubes normally operated as oscillators, amplifiers, or drivers with an anode dissipation generally of 50 watts (formerly this was 25 watts) or more per tube. These also include rectifiers with rectified power output generally of 250 watts or more.

Pulse. A pulse is a recurrent momentary flow of energy of short time duration.

Pulse duration. The time interval between the points on the trace envelope at which the instantaneous amplitudes are equal to 70 percent of the maximum amplitude, excluding spike. For magnetrons, see method 4304.

Pulse modulator and pulse diode terminology. (See MIL-STD-1311, section 4.)

Receiving tubes. Tubes so designated by the TSS. These are negative grid tubes normally operated as oscillators, amplifiers, mixers, or converters with an anode dissipation of under 50 watts (formerly this was 25 watts). These also include diodes or rectifiers with rectified power output under 250 watts.

Reference point. The reference point for the electrode potential is: The cathode terminal, if present; the negative terminal of a filament operated on direct current; or, the electrical center of the filament circuit operated on alternating current. When tests are to be made with cathode-resistor bias, the reference point for all potentials, except heater-cathode and suppressor-grid, shall be the negative terminal of the cathode resistor. The reference point for heater-cathode and suppressor-grid potentials shall be the positive terminal of the cathode resistor.

Reject failure rate. A failure rate for an individual lot that is considered to be the boundary or limit between the individual lot quality that might be tolerated occasionally (usually at a small probability of 0.10) and the individual lot quality that should not be accepted. (Analogous to LTPD in acceptance sampling.)

Residual signal (lag). Signal remaining at some specified time after exposure to light under certain specified conditions.

Resonance. Resonance of a system in forced oscillation exists when any change, however small, in frequency of excitation causes a decrease in the response of the system.

Response (of a radiation counter tube). The response of a radiation counter tube is the response when operated under specified circuit conditions and in a standard radiation field.

Ruggedized tubes. Ruggedized tubes are those which do not meet the criteria for classification as reliable tubes but which have more stringent shock and vibration requirements specified on the TSS than other military types. (The term is obsolete and was usually limited to certain low-power vacuum tubes.)

Simple harmonic motion. A motion such that the displacement is a sinusoidal function of time.

Spike. A spike is a transient of very short duration, during which the amplitude appreciably exceeds the average amplitude of the pulse.

Starting voltage (of a radiation counter tube). The starting voltage of a radiation counter tube is the voltage at which uniform pulses with specified average amplitude appear across a specified resistor and in a specified radiation field.

Subminiature tubes. Tubes with shape and dimensions designated in EIA Standard RS-209 as T2x3 (oval) and T3 (round) envelope configuration and flexible wire leads.

Supplier. Contractor, manufacturer, or vendor.

Supply potential. The supply potential is the potential furnished to a circuit containing an electron tube.

Temporary short. A temporary short is a short circuit resulting from and lasting during the application of an accelerating force. When it is necessary to classify temporary shorts as to their degree or the method of testing, the following terms are preferred:

a. A tap short is a temporary short as determined with the relatively low accelerating force as in the tap short test specified in method 1201.

b. A transient short is a temporary short of relatively short duration occurring during a high-level shock impact such as that specified in method 1041.

Time constant of rise. The time duration of a pulse to rise from 25 percent of the maximum pulse amplitude to 70 percent of the maximum pulse excluding spike, in microseconds.

Time of fall. The time duration of pulse to fall from 70 percent of the maximum pulse amplitude to 25 percent of the maximum pulse amplitude excluding spike, in microseconds.

Tube specification sheet (TSS). The document which defines the physical, electrical, and mechanical requirements of the tube and the tests necessary to verify them.

Useful power output. The power delivered to the load.

Velocity. A vector quantity that specifies the time rate of change of displacement with respect to a reference frame.

X axis (formerly X1 axis). The axis of application of shock and vibration normal to both the Z axis and the major cross section of the tube elements.

Y axis (formerly X2 axis). The axis of application of shock and vibration normal to both the X and Z axes.

Z axis (formerly Y1 and Y2 axes). The axis of application of shock and vibration which is parallel to the major axis of the tube. Unless otherwise specified on the TSS, the major axis shall be considered as: (a) The long axis of the cathode structure, or (b) the path of the undeflected beam in tubes employing electron beams.

ABBREVIATIONS AND SYMBOLS

10. PURPOSE AND SCOPE

10.1 Purpose. The purpose of this appendix is to establish a list of authorized abbreviations and symbols for electron tubes to be used on drawings, military specifications, and military standards.

10.2 Scope. This appendix contains abbreviations and symbols used in this specification and MIL-STD-1311. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

Å	Angstrom unit (0.1 nanometer)
A	Amperes (may be either ac rms or dc)
a	Amperes (peak value) or anode
a	Anode
/a	Per anode
Aac	ac amperes (rms)
α (alpha)	Attenuation constant
ac	Alternating current
Adc	dc amperes
AFR	Acceptable failure rate
ALD	Acceptance limit for sample dispersion
AQL	Acceptable quality level
ATR tube	Anti-transmit-receive tube
ΔB	Luminance change between two conditions
b = B/Yo	Normalized susceptance
β (beta)	Phase constant
B_a	Luminance level, specified or measured. Additional lower case and numerical subsripts are also used
B_D	Peak luminance level of written noise (ft_L)
be	Back electrode
B_E	Dynamic equilibrium luminance
B_S	Saturation luminance
B_{SW}	Static writing response
c	Velocity of light
C	Capacitance
°C	Degrees Celsius
cb	Centibels
ce	Collector electrode
Cgk, Cgp, Cpk, etc.	Tube capacitance between the electrodes indicated
CI	Conversion index
Cin	Input capacitance
Ck	Capacitor between cathode and ground
cℓ	Collimator electrode
Cℓ	Load capacitance
cm	Centimeter
Cmx	Center magnification
Cout	Output capacitance
cps	Cycles per second (for revisions and new TSS's, use hertz (Hz))
CRO	Cathode-ray oscilloscope
CRT	Cathode-ray tube
ct	Center tap
CW	Continuous wave
Δ (delta)	A change in the value of the indicated variable. When expressed in percent the difference in readings is divided by the initial reading and multiplied by 100
D	The active reading scan-line duration in microseconds

dB	Decibels
D1, 2, 3, 4	Deflection plates
dc	Direct current
DF	Deflection factor in volts per inch
$\frac{dik}{dt}$	Rate of rise of cathode current pulse
Disj	Peak dark current
DIsj	Dark current
Dp	Pulse droop
Du	The product of time of pulse and pulse repetition rate (duty cycle)
D_{WE}	Dynamic writing and erasing response
DD_{WE}	Dynamic decay write and erase
DVST	Direct view storage tube
dy	Dynode
e	Peak voltage
EB	Ballistic deflection
Eb, Eb1, 2, 3	dc voltage on respective anodes or collectors. In the case of multiplex tubes containing more than one operating unit, the number of the unit concerned is inserted between the voltage symbol and the element symbol. For example, E2b, E1b, E1c2, etc. The number of the unit is the number of the anode in that unit.
eb	Peak dc anode (collector) voltage
Eb'	"Off" anode voltage
Ebb	dc anode supply voltage
Ebb'	"Off" anode supply voltage
Eb/Ib	Adjust anode voltage to produce the specified anode current
ebe	Peak voltage on backing electrode
Ebe	dc voltage on backing electrode
Ec, Ec1, 2, 3	dc voltage on respective grids
Ecal	Calibrating voltage
Ecc, Ecc1, 2, 3	dc supply voltage to respective grids
Ecco	Cut-off voltage at supply
Ec/Ib	Adjust grid voltage for the specified anode current
Ece	dc voltage on collector electrode
Eco	dc cutoff grid voltage
ed	Voltage peak between anode No. 2 and any deflection plate in cathode-ray tubes
Edy	dc voltage of anode producing secondary emission
Ee	End-of-plateau voltage
Ef	Filament or heater voltage
Ef/Po	Adjust filament potential (with other potentials held constant) to reduce the power output obtained on oscillation by the amount specified
Eg1, 2, 3	rms value of ac component of input voltage for respective grids
egk	Peak voltage drop between grid and cathode
egy	Peak forward grid voltage
egx	Peak inverse grid voltage
Ehk	Heater-cathode voltage (sign to indicate polarity of heater with respect to cathode)
Eid	Ignitor voltage drop
Eip	dc ion pump voltage
ek	peak voltage on cathode
Ek	dc voltage on cathode
Ekk	Cathode pre-bias voltage
Eo	dc component of output voltage of rectifiers.
EO	Overvoltage for radiation counter tubes
eo	Pulse amplitude
Ep	rms value of the ac component of anode voltage with respect to cathode

Epp	ac anode supply voltage
epx	Peak inverse anode voltage
epy	Peak forward anode voltage
Er	Reflector voltage
Eres	Reservoir voltage
Ers	Resonator voltage
Es	dc emission voltage
Es	Starting voltages for radiation counter tubes
Esd	External shield voltage
Esg	Shield grid voltage
Esh	Shell voltage
Esh	Screen voltage
Esig	Applied signal voltage
Esj	Target voltage
Esol	dc solenoid voltage
Esp	Spade voltage
Ess	dc voltage on storage surface
Eta	Target voltage
Etd	Average voltage drop between anode and cathode
etd	Peak voltage drop between anode and cathode
Evs	dc voltage on viewing screen
Ew	dc helix voltage
ew	Peak helix voltage
Ez	Ionization, breakdown, or striking voltage
f	Filament
f	Flood-gun
f_1	The read scan-line repetition rate (Hz)
f_2	$= \frac{RJ}{D}$ (MHz)
F	Farad
F	Frequency (in Hz) 1/
FA	Maximum frequency above which receiving tube performance deteriorates seriously and sharply
fct	Filament center tap
FI	Faceplate illumination
fk	Filament-cathode return
Fsg	Frequency of signal generator
ftL	Foot Lamberts
g = G/Yo	Normalized conductance
G	Acceleration of gravity
G	Giga (10^9)
G	Gain
Gls	Large-signal gain
Gss	Small-signal gain
γ (gamma)	Propagation constant
g, g1, 2, 3	Grid (number to identify grids, starting from cathode)
1g2, 2g2, etc.	Identifies the second grid of units 1 and 2
3g1, 3g2, etc.	Identifies the first and second grids of unit 3
g2 +4	Grids having common pin connection
GA	Gas amplification
Gc	Gigacycles (kilomegacycles) (for revisions or new TSS's, use Gigahertz (GHz))
Gr	Gas ratio
GHz	Gigahertz
h	heater
H	Field strength, in gauss
H	Henry
h	The written raster height as a fraction of the storage surface reference dimension (SSRD)
hct	Heater center tap
ht	Heater tap
Hz	Hertz
i	Peak current
I	Screen brightness

1/ For revisions and new TSS's, use hertz, kilohertz, megahertz, or gigahertz.

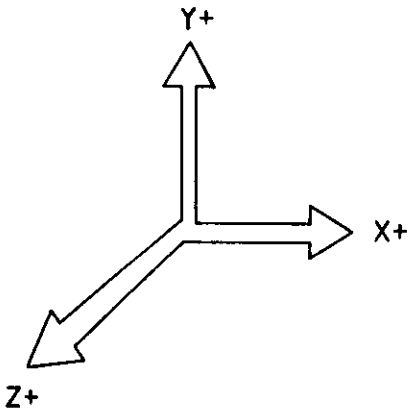
I (focus coil)	Focus coil current
Ia	Anode current
I_{av}	The average output signal current
IB, Ib1, 2, 3	dc current of respective anodes or collectors
ib	Peak value of dc anode or collector current. When used in reference to pulses, the maximum peak current excluding spike
I_{bkmax}	Maximum black signal current
I_{bkmin}	Minimum black signal current
Ibo	Idling anode current with no rf drive applied
Ic, Ic1, 2, 3	dc current of respective grid
ic	Peak grid current
iD	Peak dark current
ID	Dark current
Idy	Current of anode producing secondary emission
If	Filament or heater current
if	Intermediate frequency
Ig	rms value of ac component of grid current
Ihk	Heater-cathode leakage current
Ii	Ignitor current
Ik	dc cathode current
ik	Peak cathode current
Δik	Change in peak cathode current
iL	Peak load current
ILK	Dark current
int con	Internal connection
Io	dc component of output current of rectifiers per tube
Ip	rms value of ac component of anode current
ir	ion repeller
Ir	Reflector current
Ires	Reservoir current
Irs	Resonator current
Is	dc emission current
is	Peak emission current
$I_{S(0)}$	The output signal amplitude at the beginning of the read time interval
Isg	dc component of primary emission from grid indicated
isig	Peak signal current
Isig	Signal-output current
isj	Peak signal current
Isj	Signal-output current
isjT	Peak target current
IsjT	Target current (sum of Isj and DIsj or sum of Isig plus ID)
Iso	Isolation (in dB)
Isol	dc solenoid current
Isp	DC spade current
Ita	dc target current
Iw	dc helix current
iw	Peak helix current
I_{wmax}	Maximum white signal current
I_{wmin}	Minimum white signal current
Iz	Ionization current
J	The read scan-line length as a fraction of the SSRD
°K	Degrees Kelvin
k	Cathode
kc	Kilocycles (for revisions or new TSS's use Kilohertz (KHz))
kMc	Kilomegacycles (for revisions or new TSS's use Gigahertz (GHz))
KTB	Theoretical resistance noise power
kv	Peak kilovolts
kVA	Kilovolt amperes
kva	Peak kilovolt amperes

kVac	ac kilovolts (rms)
kVdc	dc kilovolts
kW	Kilowatts
kHz	Kilohertz
kw	Peak kilowatts
L	Lamberts
La	Arc loss
Lag	Percentage of initial value of signal-output current remaining after a specified time period following removal of illumination
LAL	Lower acceptance limit for sample average or sample median
λ (lambda)	Wavelength
λo	Resonant wavelength
Lc	Conversion loss or gain (ratio of available signal power to the available intermediate frequency power)
Ld	Duplexer loss
LIb	Leakage current
Li	Insertion loss
ℓm	Lumens
L_{pp}	The formula, 20 log L_{pp} (dB), is the dynamic range, peak-to-peak disturbance level
L_{rms}	The formula, 20 log L_{rms} (dB), is the dynamic range, rms disturbance level
LS1	Standardized light source supplied by a coiled tungsten lamp with a lead or lime glass envelope operated at a color temperature of 2,856°K
m	Meter, or one-thousandth
mm	Millimeter
mA	ac (rms) or dc milliamperes
ma	Peak milliamperes
mAac	ac milliamperes (rms)
mAdc	dc milliamperes
Mc	Megacycles (for revisions or new TSS's use Megahertz (MHz))
Meg	Megohms
mftL	Millifoot Lamberts
mH	Millihenry
MHz	Megahertz
mL	Millilamberts
MP	Missing rf pulses in percent
mr	Milliroentgen
MRSD	Maximum rated standard deviation
ms	Milliseconds
msi	Milligrams per square inch (plating)
MTF	Modulation transfer function
Mu or u (μ)	Amplification factor
mv	Peak millivolts
mVac	ac millivolts (rms)
mVdc	dc millivolts
MW	Megawatts
Mw	Peak megawatts
mW	Milliwatts
n	*nano* (10^{-9})
N	Counts for radiation counter tubes
N	Number of scan-lines written
nc	No connection
NF	Noise figure
Npm	*Counts per minute*
Nps	Counts per second
Nr	Output noise ratio (ratio of noise power output to resistance noise power)
Os	Pulse overshoot
p	pico (10^{-12})

p- - - - - - - - - - - - - - - -	Plate (for revisions or new TSS's use anode)
p- - - - - - - - - - - - - - - -	Spatial frequency in terms of cycles/SSRD for which the modulation is determined
/p - - - - - - - - - - - - - - -	Per plate (per anode)
P/ta - - - - - - - - - - - - - -	Individual target power dissipation
Pb - - - - - - - - - - - - - - -	Anode breakdown factor or anode heating factor (epy x prr x ib)
Pd - - - - - - - - - - - - - - -	Average drive power
pd - - - - - - - - - - - - - - -	Peak drive power
pF - - - - - - - - - - - - - - -	Picofarad
PFN- - - - - - - - - - - - - - -	Pulse forming network
Pg1, 2, 3- - - - - - - - - - - -	Power dissipation of respective grid
Pi - - - - - - - - - - - - - - -	Power input (anode)
Pi (rf)- - - - - - - - - - - - -	Average input rf power
pi - - - - - - - - - - - - - - -	Peak power input
pi (rf)- - - - - - - - - - - - -	Peak input rf power
Pj - - - - - - - - - - - - - - -	Reactive power in watts
Pl - - - - - - - - - - - - - - -	Plateau length
Pn - - - - - - - - - - - - - - -	Noise output
P'o- - - - - - - - - - - - - - -	Intrinsic P
Po - - - - - - - - - - - - - - -	Average power output
$\overline{Po}$ $\overline{Du}$ - - - - - - - - - - - - - - -	Peak power output
ΔPo Ef, etc.- - - - - - - - - - - -	Change in Po, etc., of an indifidual tube caused by the specified change in Ef
ΔPo t, etc. - - - - - - - - - - - - -	Change in Po, etc., caused by a test (life, shock, fatigue, etc.)
po - - - - - - - - - - - - - - -	Peak power output
Pp - - - - - - - - - - - - - - -	Plate or anode power dissipation
Pp - - - - - - - - - - - - - - -	Power dissipation, collector (TWT)
pps- - - - - - - - - - - - - - -	Pulses per second
Pre-TR tube- - - - - - - - - - -	Pre-transmit-receive tube
prf- - - - - - - - - - - - - - -	Erase pulse repetition frequency
prr- - - - - - - - - - - - - - -	Pulse recurrence rate or repetition rate in pulses per second
Ps - - - - - - - - - - - - - - -	Relative plateau slope
Q- - - - - - - - - - - - - - - -	Figure of merit
QA - - - - - - - - - - - - - - -	Qualification approval
QCI- - - - - - - - - - - - - - -	Quality conformance inspection
QL - - - - - - - - - - - - - - -	Loaded Q
Qo - - - - - - - - - - - - - - -	Intrinsic Q or quality of a circuit without external loading
QPL- - - - - - - - - - - - - - -	Qualified products list
r- - - - - - - - - - - - - - - -	Reflector
r- - - - - - - - - - - - - - - -	Roentgen
R- - - - - - - - - - - - - - - -	Resistance
R- - - - - - - - - - - - - - - -	The anticipated limiting resolution of the tube in written raster scan-line(s)/SSRD
Rb - - - - - - - - - - - - - - -	dc resistance of external anode circuit (bypassed)
Rc - - - - - - - - - - - - - - -	dc resistance of external grid circuit (bypassed)
Rc - - - - - - - - - - - - - - -	Reference resistor for noise-ratio measurements (for crystal rectifiers)
rf - - - - - - - - - - - - - - -	Radio frequency
Rf - - - - - - - - - - - - - - -	Resistance in series with filament or heater
RFR- - - - - - - - - - - - - - -	Reject failure rate
Rg - - - - - - - - - - - - - - -	Resistance in series with grid
rg - - - - - - - - - - - - - - -	Dynamic internal grid resistance
Ri - - - - - - - - - - - - - - -	Cathode interface resistance
Rk - - - - - - - - - - - - - - -	Resistance in series with cathode
Rka1, Rka2, Rkrs, Rfrs, etc. - -	Tube resistance between the electrodes indicated
Rℓ - - - - - - - - - - - - - - -	Load resistance

rms	Root mean square
Rp	Resistance in series with plate or anode
rp	Dynamic internal anode resistance of tube
rrv	Rate of rise of voltage pulse
rpc	Roundness of current pulse
rs	Resonator
Rsp	Resistance in series with spade
$R_{SW(V,S)}$	The static writing response
Rta	Resistance in series with target
Rv	Video impedance
S	Static sensitivity (phototubes)
S	Scanning speed in inches per second
s	Dynamic sensitivity (phototubes)
Sc	Conversion transconductance
Sd	Spectral distribution
sd	Shield
se	Starter electrode
SE	Luminance uniformity factor under static erasing conditions
sh	Shell
σ (sigma)	"Input" standing wave ratio in voltage
σ' (sigma prime)	"Output" standing wave ratio in voltage
Sm	Transconductance (control grid anode)
Smg1, g2, etc.	Transconductance between the elements indicated
ΔSm Ef, etc.	Change in Sm, etc., of an individual tube caused by the specified change in Ef
ΔSm t, etc.	Change in Sm, etc., caused by a test (life, shock, fatigue, etc.)
sp	Spade
spo	Spurious power output
Sr	Sensitivity ratio (maximum Ib to minimum Ib)
ss	Storage surface
SSB	Single sideband
S_W	Output signal uniformity factor
SW	Luminance uniformity factor under static writing conditions
SSRD	Storage surface reference dimension
T	Temperature (degrees Celsius (centigrade))
t	Test duration (seconds, unless otherwise specified)
Δt	A time interval in suitable units
T_1, T_2	Specific measured time periods
TA	Ambient temperature
ta	Target
tad	Anode delay time (see method 3256)
Δtad	Anode delay time drift (see method 3256)
T_D	Reading time, usable
TE	Envelope temperature
TF	Flange temperature measured at point shown on outline drawings
tf	Time of fall
tfc	Time of fall of current pulse
tfv	Time of fall of voltage pulse
t_q	Total time the erase train is applied
TH_g	Temperature of condensed mercury in °C
TIR	Total indicator reading
tj	Variation in firing time (time jitter)
tk	Cathode-conditioning time (in seconds) necessary before the application of high voltage. In TR tubes, time delay between application of ignitor voltage and rf power
tp	Erase pulse width
tp	Pulse duration (excluding magnetrons)
tpc	Duration of current pulse

TR tube	Transmit-receive tube
tr	Time constant of rise (excluding magnetrons)
trc	Time of rise of current pulse in microseconds (for magnetrons)
trf	RF pulse duration
trv	Time of rise of voltage pulse in microseconds
tsrv	Time of steepest rise of the voltage pulse
TSS	Tube specification sheet
TUT	Tube under test
	Indicated direction of power input and output of the TUT. (This symbol indicates input at left side, output at right side.)
TWT	Traveling-wave tube
μ	Amplification factor
μa	Microamperes, peak value
μAac	ac microamperes (rms)
μAdc	dc microamperes
UAL	Upper acceptance limit for sample average or sample median
μmhos	Micromhos
μF	Microfarads
μH	Microhenries
μs	Microseconds
μμf	Micromicrofarads (for revisions or new TSS's, use picofarads (pF))
μVac	ac microvolts (rms)
μVdc	dc microvolts
μW	Microwatts
V	Grid drive
V	Volts (may be either ac rms or dc)
v	Volts, peak value
∿p	The frequency equivalent of p in cycles/t
VA	Volt amperes
va	Peak volt amperes
Vac	ac volts (rms)
Vdc	dc volts
v/in.	Volts, peak value, per inch of deflection
Vj	Voltage jitter
vs	Viewing screen
VSWR	Voltage standing wave ratio
vu	Volume units
Vx	Extinguishing voltage
w	Writing gun
W	Watts
w	Peak watts
WRSL	Written raster scan-line(s)
Ws	Spike-leakage energy
X	X axis (see appendix A)
X^+, X^-, Y^+, etc.	Directional axis designations for use in shock and vibration tests. The plus and minus directions shall be specified on the TSS in accordance with the sketch on the following page.



RIGHT HAND COORDINATE SYSTEM

X1 (obsolete, use X)
X2 (obsolete, use Y)
x- - - - - - - - - - - - - - - - Peak inverse value
X_i - - - - - - - - - - - - - - - The assigned abscissa integer values of the line spread function
Y- - - - - - - - - - - - - - - - Y axis (see appendix A)
Y1 (obsolete, use Z)
Y2 (obsolete, use Z)
y- - - - - - - - - - - - - - - - Peak forward value
Y_i - - - - - - - - - - - - - - - The value of the line spread function at point X_i
Z- - - - - - - - - - - - - - - - Impedance
Z- - - - - - - - - - - - - - - - Z axis (see appendix A)
Zd - - - - - - - - - - - - - - - Impedance to anode of deflection plate circuit at power supply frequency
Zg - - - - - - - - - - - - - - - Impedance of the grid circuit
Zgg- - - - - - - - - - - - - - - Impedance between grids of push-pull circuit
Zgk- - - - - - - - - - - - - - - Impedance between grid and cathode
Zi - - - - - - - - - - - - - - - Input impedance
ZL - - - - - - - - - - - - - - - Load impedance (with negligible dc resistance)
Zm - - - - - - - - - - - - - - - Modulator frequency load impedance
Zo - - - - - - - - - - - - - - - Output impedance or characteristic impedance
Zp - - - - - - - - - - - - - - - Impedance in anode circuit
Zpp- - - - - - - - - - - - - - - Impedance between anode in push-pull circuit
1D2- - - - - - - - - - - - - - - Deflection produced by the deflection plates nearer the screen (for cathode-ray tubes)
3D4- - - - - - - - - - - - - - - Deflection produced by the deflection plates nearer the base (for cathode-ray tubes)

** - - - - - - - - - - - - - - - Qualification test
*- - - - - - - - - - - - - - - - Standard-design test
#- - - - - - - - - - - - - - - - Special-design test
- - - - - - - - - - - - - - - Periodic-check test
←- - - - - - - - - - - - - - - - Indicates change on TSS
†- - - - - - - - - - - - - - - - Test to be performed at the conclusion of the holding period

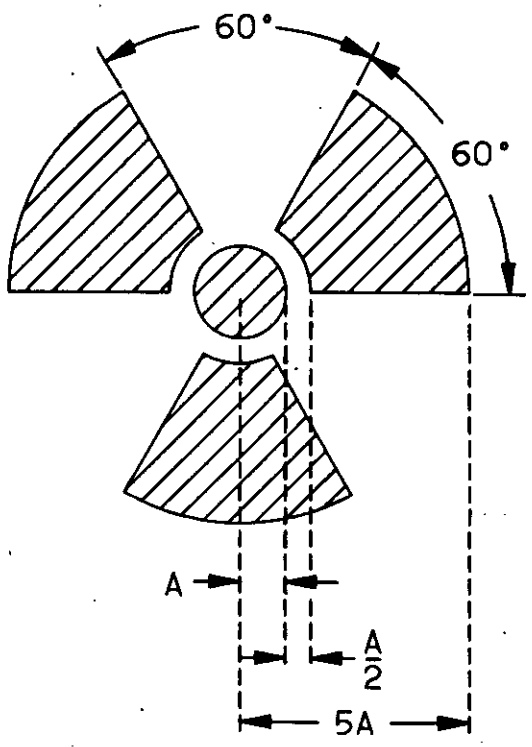
} Obsolete

 - - - - - - - - - - - - - - - Directional coupler

Ⓐ , Ⓑ , Ⓒ , etc. - - - - - - Indicates a change to the TSS performed during the first or subsequent revisions

RADIATION SYMBOL (see 3.6.8)

1. Cross-hatched area shall be magenta or purple.
2. Background shall be yellow.



DESIGN AND CONSTRUCTION DATA - ELECTRON TUBES AND ACCESSORIES

10. SCOPE

* 10.1 Scope. This appendix provides for the standardization of shapes and sizes of electron tubes, their component parts, and accessories in order to assure mechanical interchangeability (see 3.5). This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

20.1 Industry publications. The latest revisions of the following documents form a part of this appendix to the extent specified herein.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

RS-191 - Measurement of Direct Interelectrode Capacitances for Electron Tubes.
RS-209 - Standards for Electron Tubes.

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, N.W. Washington, D.C. 20006.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

20.2 Order of precedence. In the event of a conflict between the text of this appendix and the references cited herein, the text of this appendix shall take precedence.

* 30. TUBE OUTLINE DRAWINGS

30.1 Tubes and component parts. Electronic Industries Association (EIA) Standard RS-209 shall be used whenever the TSS covers a tube or component part which has an applicable EIA outline drawing indicated.

30.1.1 EIA outline drawing number. The EIA outline drawing number shall be indicated; e.g., 5-1 (EIA), on the TSS in all cases where an EIA outline drawing number is assigned. When a particular configuration is not indicated in RS-209, a dimensional drawing shall be included on the TSS.

30.1.2 Metric equivalents. The equivalent metric dimensions provided on each drawing are for general information only.

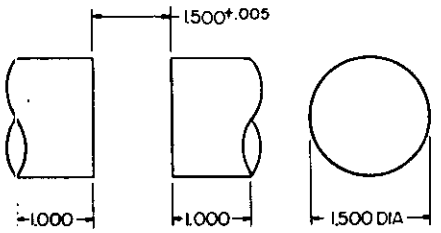
30.1.3 Tube outline drawings. Tube specification sheets processed prior to September 1965 may have indicated a MIL-E-1 outline drawing number. For these cases an outline drawing cross-reference list is shown in table C-I.

30.2 Capacitance shields. Standardized capacitance shields, sockets, and cap connectors for use in measuring direct-interelectrode capacitances shall be as indicated in EIA Standard RS-191.

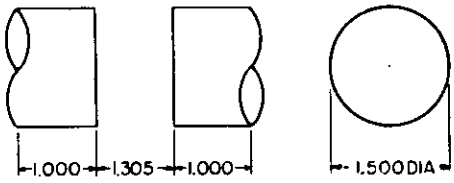
30.3 Magnetron tube components. Unless otherwise specified, pole tips/gaps and terminal plugs/jacks for magnetron tubes shall be as shown on figures C-1 and C-2.

TABLE C-I. Cross-reference, tube outline drawings.

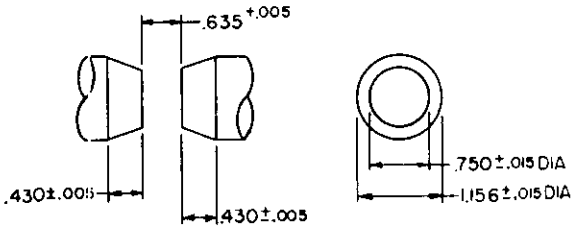
Former MIL-E-1 tube outline No.	Equivalent EIA No.	Former MIL-E-1 tube outline No.	Equivalent EIA No.
1- 4	9-26	6- 1	5- 1
1- 6	12- 5	6- 2	5- 2
1- 7	12- 6	6- 3	9-30
1- 9	12- 2	6- 4	9-31
2- 2	14- 1	6- 5	5- 3
2- 3	14- 2	6- 6	6- 1
2- 4	16- 1	6- 7	6- 2
3- 1	9- 1	6- 8	6- 3
3- 4	9- 7	8- 1	3- 1
3- 5	9-17	8- 2	3- 2
3- 6	9-11	8- 3	3- 8
3- 7	9-18	8- 4	3- 3
3- 8	9-12	8- 5	3- 4
3- 9	9-13	8- 7	3- 6
3-10	9-15	8- 8	2- 1
3-11	9-21	8- 9	2- 2
3-12	9-36	8-10	2- 5
3-13	9-39	8-11	2- 6
3-14	9-41	16- 2	16- 2
3-15	9-42		
3-16	9-43		
3-17	9-45		
3-18	9-47		
3-19	9-22		
4- 4	12- 7		
4- 5	12- 8		
4- 6	12- 3		
4- 7	12- 4		
4- 8	14- 3		
4- 9	16- 3		
5- 1	8- 5		
5- 2	8- 3		
5- 3	8- 1		
5- 4	8- 4		
5- 5	8- 2		
5- 6	8- 6		
5- 8	10- 1		



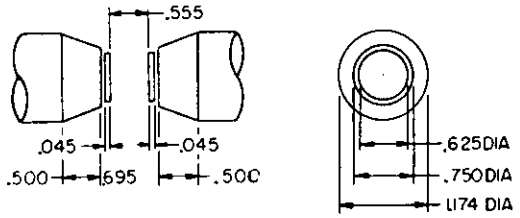
22-1



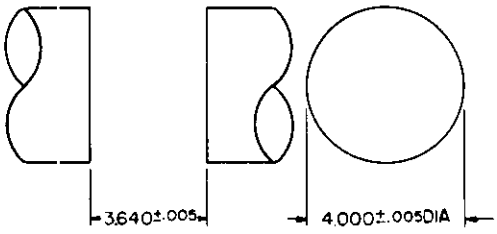
22-2



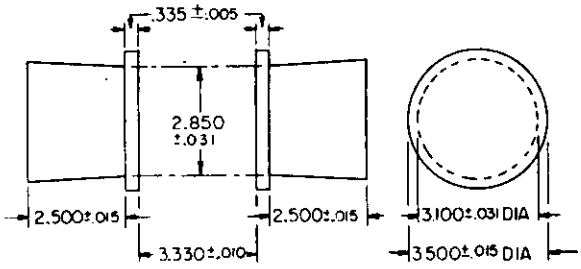
22-3



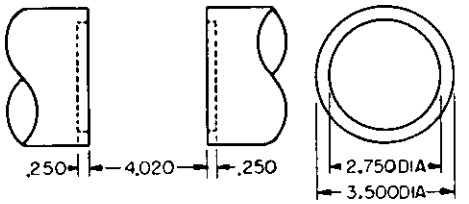
22-4



22-5

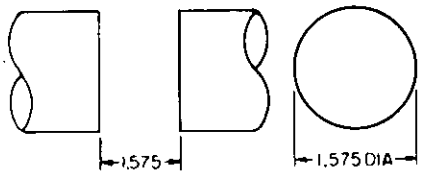


22-6

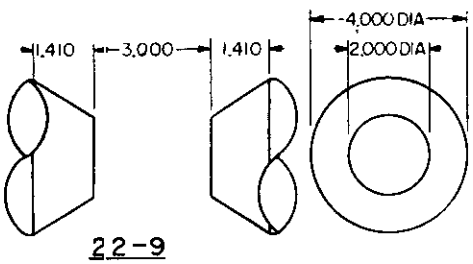


22-7

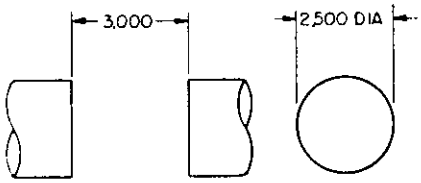
INCHES	MM	INCHES	MM
.005	0.13	1.156	29.36
.010	0.25	1.174	29.82
.015	0.38	1.305	33.15
.031	0.79	1.410	35.81
.045	1.14	1.500	38.10
.250	6.35	1.575	40.01
.335	8.51	2.000	50.80
.430	10.92	2.500	63.50
.500	12.70	2.750	69.85
.555	14.10	2.850	72.39
.625	15.88	3.000	76.20
.635	16.13	3.100	78.74
.695	17.65	3.330	84.58
.750	19.05	3.500	88.90
1.000	25.40	3.640	92.46
		4.000	101.60
		4.020	102.11



22-8



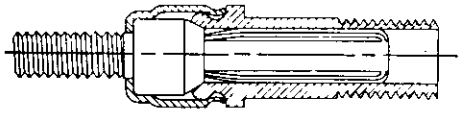
22-9



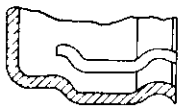
22-10

NOTES:
1. Dimensions are in inches.
2. Dimensions without tolerances are for information only.
3. Material shall be soft iron or cold rolled steel.
4. Side and end views of pole faces are shown.

FIGURE C-1. Pole tips and gaps for magnetron tubes.

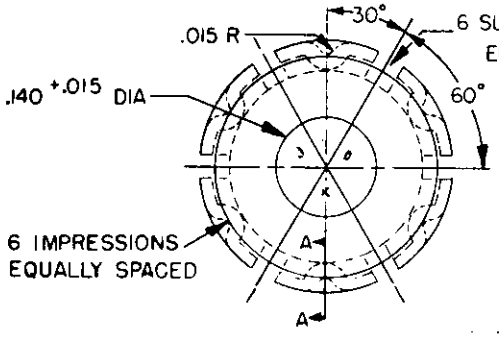


ASSEMBLY



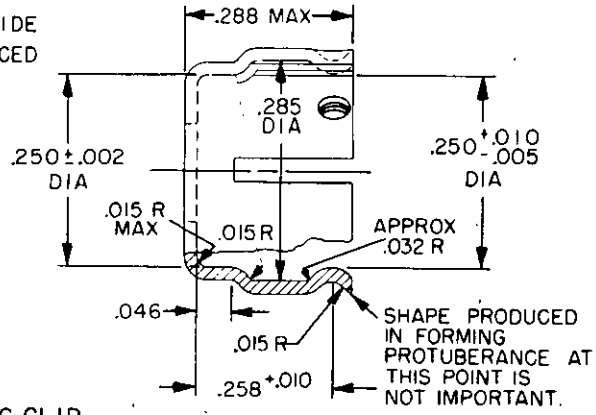
DETAIL OF ALTERNATE METHOD OF MAKING GROOVE. SPUN IN AROUND SKIRT, TAKING PLACE OF IMPRESSIONS.

INCHES	MM	INCHES	MM
.002	0.05	.109	2.77
.003	0.08	.140	3.56
.005	0.13	.169	4.29
.010	0.25	.234	5.94
.015	0.38	.247	6.27
.016	0.41	.250	6.35
.020	0.51	.254	6.45
.025	0.64	.258	6.55
.031	0.79	.281	7.14
.032	0.81	.285	7.24
.038	0.97	.288	7.32
.046	1.17	.312	7.92
.047	1.19	.375	9.53
.071	1.80	.468	11.89

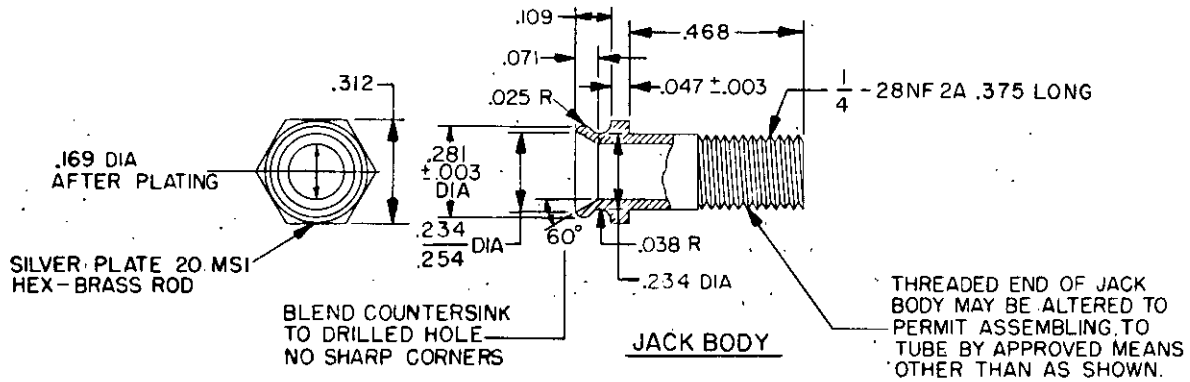


#26 (016) B. & S. GAGE BERYLLIUM COPPER SHEET. HEAT TREAT AFTER DRAWING TO SPRING TEMPER. SILVER PLATE 20 MSI.

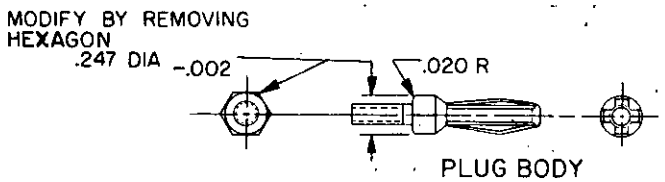
SPRING CLIP



SECTION A-A



JACK BODY



PLUG BODY

MAKE FROM COMMERCIAL 274 GENERAL RADIO PLUG OR EQUIVALENT SILVER PLATE 20 MSI

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerances are ±.005, ±1/2° on angles.

FIGURE C-2. Locking jack and plug for magnetron tubes.

VISUAL AND MECHANICAL INSPECTION CRITERIA

10. SCOPE

10.1 Scope. This appendix establishes uniform criteria for evaluating and classifying defects on the individual tubes during visual and mechanical (physical) inspection. The criteria shall apply whether a 100-percent inspection or a sampling plan procedure is used. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

* 20.1 Industry publications. The latest revisions of the following documents form a part of this appendix to the extent specified herein.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA Tube Publication TEP No. 29; Hard Glass Bulb Criteria and Bulb Outlines (August 1963)

EIA Tube Publication TEP No. 123; Glossary, Terms used in the Description of Glass Components and their Defects (March 1962)

RS-209 - Standards for Electron Tubes.

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, N.W., Washington, D.C. 20006).

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

20.2 Order of precedence. In the event of a conflict between the text of this appendix and the references cited herein, the text of this appendix shall take precedence.

* 30. GENERAL INSTRUCTIONS

a. Visual and mechanical. The tubes comprising the sample shall be subjected to visual and mechanical inspection for overall workmanship and all applicable defects specified in this appendix. To establish the AQL for each defect listed, the degree of defect is indicated to the right of the defect description. Individual tubes shall not be rejected for control defects; however, if the AQL of 6.5 percent for such defects in any lot is exceeded, the lot shall be rejected. The decision to accept or reject the lot shall be made independently for each defect which has an AQL designated. Unless otherwise specified, visual and mechanical inspection shall be conducted as level I of MIL-STD-105. The AQL values shall be as shown in table D-I.

TABLE D-I. AQL for visual and mechanical inspection.

Type defect	AQL
Major 1	1.0% (combined defects)
Major 2	1.0% (each defect)
Minor	2.5% (combined defects)
Control	6.5% (each defect)

b. Dimensions.

(1) The physical characteristics of tubes shall be inspected for conformance with the specified outline drawing. Quality assurance provisions for standard outlines shall be as specified in table D-II. For tube configurations not listed in table D-II, an outline drawing and inspection provisions shall be included on the TSS. Reference (nominal) dimensions (those without tolerances) are for information only, not for inspection.

* TABLE D-II. Standard inspection provisions for EIA outlines.

The following outline drawing prefix (T) numbers and reference letters refer to EIA Standard RS-209 designations. (See appendix C.)

Outline prefix (T)	Reference letters	Inspection level	AQL %
2X3, 3, 5-1/2, 6-1/2	A through E	I	1
2X3, 3, 5-1/2, 6-1/2	G, H, and note 8 of outline T2X3 and notes 4 and 5 of outline T3(3-6)	S3	6.5
8,9,10,11,12,14,16 (based types)	A, C, and D	S3	6.5
8,9,10,11,12,14,16 (based types)	L and M	1/	Part 3 1/
9 and 12 (all glass)	A through E (where shown)	I	1

1/ See 4.1.1e

(2) Cathode-ray tube and cathode-ray charge storage tube dimensions with tolerances specified shall be inspected to an AQL of 6.5, level S3.

c. Magnification. Unless otherwise specified (see 50.1, this appendix), inspection shall be made without magnification.

d. Criteria. In addition to the general criteria for all tubes specified in 40. of this appendix, supplementary criteria for specific application are located as follows:

Application	Paragraph
General instructions	30.
General criteria	40.
Miniature and subminiature receiving tubes	50.
Transmitting and power rectifier tubes	60.
Cathode-ray tubes	70.

* 30.1 Glass defects and terminology.

a. Envelopes. Terms used in the description of glass components and of their defects shall be as specified in EIA Tube Publication TEP No. 123.

b. Screens and faceplates. Cathode-ray and visual output cathode-ray charge storage tube screen and faceplate defects, and terms shall be as indicated in EIA Tube Publication TEP No. 123, supplemented by the following:

1/ (1) Bright spot. A small area of light on the tube screen with an intensity (fluorescent or phosphorescent) at least twice the brightness of the surrounding area. Its color need not be the same as that of the surrounding area.

(2) Chill wrinkle. Fine ripples or waves on the surface of the glass.

1/ (3) Color. In these criteria "color", unless otherwise specified, refers to the color observed with the screen activated.

1/ (4) Color spot. A small area which is noticeably discolored and which has a fluorescent or phosphorescent intensity substantially different from the surrounding area but not within the limits of dead or bright spots.

1/ (5) Combination spots. Spots which appear to have combinations of the characteristics of dead, bright, and color spots, shall be classified as the type they most resemble.

1/ (6) Dead spot. A small area which emits practically no light for example, holes and nonfluorescent or nonphosphorescent spots in the screen, and opaque particles, open blisters, and bruise checks in the faceplate glass.

(7) Face-contour variation. Variation in the inside or outside face surface contour, such as "bull's-eye top" or "suck-up".

(8) Lap. A fold in the surface.

(9) Loading mark. Minute variable indentations on the surface of the glass caused by air.

1/ (10) Shaded or mottled area. Minor gradation in color or luminous intensity with respect to overall screen background, such as may be caused by uneven screen distribution, water marks, mold or loading marks, and scum or spew.

(11) Surface blemish. Inside or outside surface defect such as spot, chill wrinkle, and cord.

1/ Applies to cathode-ray tubes only.

* 40. GENERAL CRITERIA. The following criteria shall be applicable unless superseded in other portions of this appendix covering specific families of tubes.

40.1 Glass-envelope defect classification.

Soft and hard glasses. Unless otherwise specified herein, the criteria in 40.1.1 through 40.1.8 are established for glass codes as specified in EIA Tube Publication TEP No. 29.

40.1.1 Stones.

a. Soft glass stones.

(1) Size and number.

Up to 0.010 inch (.25 mm) - - - - - - - - - - - - - - -	Acceptable
0.011 (.28 mm) to 0.020 inch (.51 mm) - If in quantity of four or more- - - - - - - - - - - - - - -	Minor
0.021 inch (.53 mm) and more- - - - - - - - - - - - - -	Minor

b. Hard glass stones.

(1) Size and number.

Stones less than one-half the allowable dimensions shall not be considered- - - - - - - - - - - - - - - - - - - -	Minor
Up to and including 0.047 inch (1.19 mm) - - - - - - - - -	Acceptable
Over 0.047 inch (1.19 mm) - Size and number greater than as specified in EIA Tube Publication TEP No. 29 for acceptable stones- - - - - - - - - - - - - - - - - - - -	Minor

(2) Overglazing. Stones more than 0.031 inch (.75 mm) not overglazed - Minor

40.1.2 Blisters.

a. Soft glass blister (see figure D-1).

(1) Open blisters. Open-surface blisters 0.025 inch (.64 mm) or more- Minor

(2) Buried or unbroken surface blisters. No attempt shall be made to break unbroken blister.

Total number and class of blisters 0.025 inch (.64 mm) and more - Minor

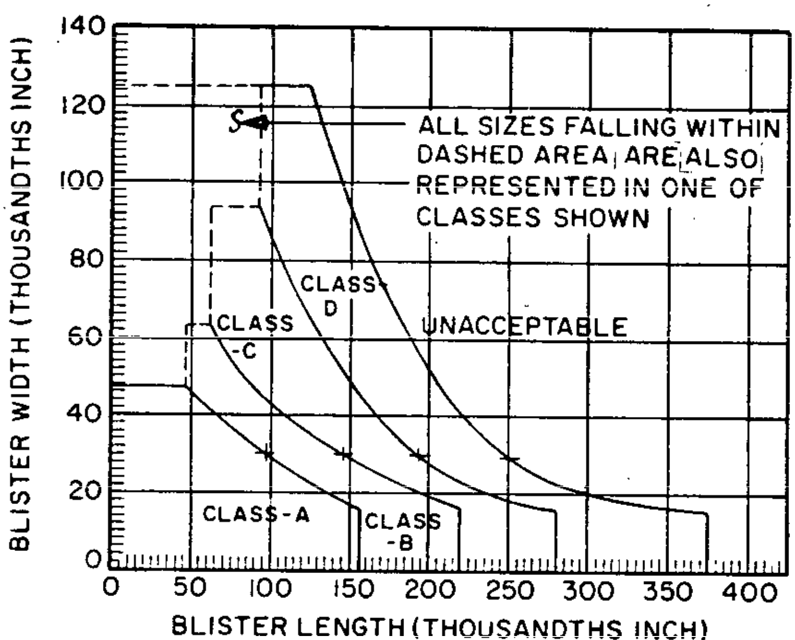


FIGURE D-1. Classification of soft glass unbroken blister sizes.

b. Hard glass blisters.

(1) Open-surface blisters 0.031 inch (.79 mm) or more. Accept if raw edges of the open-surface blisters are finished off- Minor

(2) Buried or unbroken blisters (class A or B, glass). No attempt shall be made to break unbroken blisters - - - - - - - - Minor

Reject if:

Four or more blisters with a maximum dimension of more than 0.188 inch (4.78 mm) occur in any area bounded by a one inch (25.4 mm) circle, or 13 or more blisters with a maximum dimension between 0.031 (.79 mm) and 0.047 inch (1.19 mm) occur in any area bounded by a one inch (25.4 mm) circle, or size of any blister is greater than as specified in EIA Tube Publication TEP No. 29 for acceptable unbroken blisters.

40.1.3 Scratches. Scratches on the envelope that exceed 0.010 inch (.25 mm) in width and aggregate length of more than 3.00 inches (76.2 mm) - - - - Minor

40.1.4 Glass adhered. Maximum dimension of adhered glass more than 0.094 inch (2.39 mm)- Minor

40.1.5 Checks and cracks. Crack extending into or through the wall of the glass envelope. This does not include surface checks or cracks due to impact, that are less than 0.04 inch (1.02 mm) in the largest surface dimension - Major 1

40.1.6 Scale. Acceptable scale on hard glass bulbs in accordance with EIA Tube Publication TEP No. 29 - Minor

40.1.7 Glass knots (hard glass). Maximum dimensions and number of knots greater than as specified in EIA Tube Publication TEP No. 29. Maximum total length of string of knots shall be 6 inches (152.4 mm) in one envelope- - - - - Minor

40.1.8 Tip defects.

a. Sharp tips. Sharp, chipped, or stringy - - - - - - - - - - - - - - - - - Minor

b. Re-entrant (sucked-in) exhaust tip. Re-entrant depth more than one-third of tip diameter - Control

40.2 Metal envelope defect classification.

40.2.1 Dents.

a. Number. More than two dents in a tube- - - - - - - - - - - - - - - - - - Minor

b. Depth. Any dent more than 0.031 inch (.79 mm) in depth - - - - - - - - Minor

40.2.2 Paint finish.

a. Crimping. The base wafer crimping process causes exposed body metal to a distance more than 0.094 inch (2.40 mm) above top edge of base wafer- Minor

b. Mars and peeling blemishes. Combined total area of exposed metal more than 0.250 (6.35 mm) by 0.125 inch (3.18 mm), or equivalent area- Minor

c. Scratches. A scratch on the painted surface exposing body metal more than a half inch (12.7 mm) in length for metal receiving tube types or 2 inches (50.8 mm) in length for other types- - - - - - - - - - Minor

40.3 Base, base pin, insert, and cap defect classification.

40.3.1 Thermosetting plastic bases.

40.3.1.1 Side blisters.

a. Buried or unbroken surface. Outside diameter of base more than maximum. (Unbroken blisters shall be subjected only to pressure of a fingernail)- Major 1

b. Open blisters.

(1) Size. Any single open-surface blisters more than 0.125 by 0.125 inch (3.18 mm), or equivalent area- - - - - - - - - - - - Minor

(2) Number. More than five open-surface blisters more than 0.030 inch (.76 mm) in maximum dimension - - - - - - - - - - - - - - Minor

40.3.1.2 Bottom blisters.

a. Position. Blisters connecting any two base pins- - - - - - - - - - - Major 1

b. Height. Blister more than 0.010 inch (.25 mm) in height- - - - - - - Major 1

c. Type. Open-surface blisters more than 0.030 inch (.76 mm) in maximum dimension. (Unbroken blisters shall be subjected only to pressure of a fingernail) - Minor

40.3.1.3 Guide lug blisters. Outside diameter of lug more than maximum - Major 1

40.3.1.4 Chips.

a. Size. Chips less than 0.030 inch (.76 mm) in maximum dimension shall be accepted.

b. Depth. Individual chips more than 0.031 inch (.79 mm) in depth - Minor

c. Area. Chips more than 0.125 by 0.125 inch (3.18 mm) or equivalent area- Minor

d. Location.

(1) Corner chips. Corner chips extending more than 0.125 inch (3.18 mm) along any of the intersecting surfaces - - - - - - - - Control

(2) Guide lug key. Guide lug key chips more than 0.030 inch (.76 mm) in longest dimension- Minor

40.3.1.5 Combinations. More than five open-surface blisters or five chipped places- Minor

40.3.1.6 Cracks. Any cracks - Major 1

40.3.1.7 Scratches. Base scratch over 0.750 inch (19.05 mm) long and having sufficient depth to definitely catch a fingernail (scratches which do not catch a fingernail shall not be rejected)- - - - - - - - - - - - - - - - - - Control

40.3.2 Ceramic bases.

40.3.2.1 Chips.

a. Depth. Individual chips more than 0.031 inch (.79 mm) in depth - - - Minor

b. Area. Chips more than 0.125 by 0.125 inch (3.18 mm), or equivalent area - Minor

c. Location.

(1) Corner. Corner chips extending more than 0.125 inch (3.18 mm) along any of the intersecting surfaces - - - - - - - - - - - - - - - Minor

(2) Guide lug key. Guide lug key chipped- - - - - - - - - - - - - - Major 1

40.3.2.2 Combinations. More than five open-surface blisters or five chipped places- Minor

40.3.2.3 Cracks.

a. Deep cracks. Any body cracks - Major 1

b. Glaze cracks.

(1) Any glaze cracks extending from one pin to another - - - - - - - - Minor

(2) Any other glaze cracks - Control

40.3.2.4 Scratches. Base scratched- Control

40.3.3 Metal bases.

40.3.3.1 Dents.

a. Number. More than two dents in a tube- - - - - - - - - - - - - - - - - Minor

b. Depth. Any dent more than 0.031 inch (.79 mm) in depth - - - - - - - Minor

40.3.3.2 Plating.

a. A scratch exposing base metal more than 0.500 inch (12.70 mm) in length - Minor

b. Scratches not exposing base metal - - - - - - - - - - - - - - - - - - Control

40.3.3.2.1 Peeling and blistering.

a. Any peeling of plating where plating is required for electrical reasons - Major 1

b. Peeling of plating where appearance is seriously affected - - - - - - Minor

c. Pealing of plating, or blisters, where appearance is involved, provided the appearance of the tube is not seriously affected - - - Control

40.3.4 Base pins.

40.3.4.1 Bayonet pins.

a. Lateral motion. Total lateral motion more than 0.016 inch (.41 mm)- - Minor

b. Rotation.

(1) The staked bayonet pin rotates, but cannot be pushed into base wall - Control

(2) Unstaked pin rotates - Minor

40.3.4.2 Contact pins.

a. Lateral motion. Total lateral motion of contact pins, other than pins sealed directly in glass, more than 0.031 inch (.79 mm) at pin tip when moved with the fingers - - - - - - - - - - - - - - - - - - - Minor

b. Rotation. Any contact pin rotation - - - - - - - - - - - - - - - - - - Minor

c. Alinement. Pin alinement not conforming to pin alinement gage when gage is specified- Minor

40.3.4.2.1 Increased diameter by solder. Maximum diameter by presence of solder is more than that specified in table D-III- - - - - - - - - - - - - - - Minor

TABLE D-III. Increased diameter of contact pin.

Bogey pin diameter (base drawing) Inch	mm	Maximum diameter Inch	mm
0.093	(2.36)	0.098	(2.49)
.125	(3.18)	.131	(3.33)
.156	(3.96)	.162	(4.11)
.187	(4.75)	.195	(4.95)
.312	(7.92)	.320	(8.13)

40.3.5 Base inserts.

40.3.5.1 Ceramic wafer.

a. Deep cracks - Major 1

b. Glaze cracks extending from any pin to another pin or to the sleeve Minor

40.3.5.2 Glass. Unless otherwise specified, all cracks and chips on candelabra or other lamp bases with glass insulation shall be accepted.

40.3.6 Soft-solder defects.

a. Loose or unsoldered wires. Loose or unsoldered wire or wires in pins or caps - Major 1

b. Exposed wire. More than 0.031 inch (.79 mm) of wire length exposed beyond end of pin or cap, or 0.031 inch (.79 mm) of wire length exposed beyond solder when end of pin or cap is concealed by solder - Minor

c. Excess solder on pin. Criteria specified in 40.3.4.2.1 shall be used.

40.3.7 Envelope-to-base.

a. Alinement.

(1) Envelope and base alinement for miniature types. The maximum angle between base and bulb shall be within 90 ±3.5 degrees- Minor

(2) Envelope and base alinement for subminiature types. The maximum angle between base and bulb shall be within 90 ±5 degrees- Control

(3) Envelope and base alinement for other than miniature and subminiature types. The maximum angle between base and bulb shall be 90 ±2.5 degrees- Minor

b. Looseness. Any looseness of cemented junction of base- - - - - - - Major 1

c. Excess cement.

(1) Cement protruding more than 0.062 inch (1.57 mm) on bases less than 1.500 inches (38.10 mm) in diameter- - - - - - - - - - Minor

(2) Cement protruding more than 0.188 inch (4.78 mm) on bases 1.500 inches (38.10 mm) or more in diameter- - - - - - - - - - - Minor

d. Voids.

(1) Bases used for tube support failing base, cap, and insert secureness test- Major 1

(2) Bases not used for tube support and voids not totaling more than one-eighth of tube circumference- - - - - - - - - - - - - - Control

40.3.8 Wafer-to-base or envelope.

a. Rotation. Total rotational movement of wafer with respect to crimped metal more than 0.031 inch (.79 mm) when tried with the fingers - Minor

b. Lateral motion. Any movement separating any part of the wafer away from the crimped metal more than 0.016 inch (.41 mm) when tried with the fingers- Minor

c. Crimping. The base-wafer crimping process causes exposed body metal to a distance more than 0.094 inch (2.39 mm) above top edge of base- Minor

40.3.9 Cap-to-envelope.

a. Alinement. Centerline of cap departing from centerline of bulb by more than 10 percent of diameter of dome - - - - - - - - - - - - - - - Minor

b. Looseness. Any looseness of cemented junction of cap - - - - - - - - Major 1

c. Rotation. Total rotation movement from cap to envelope of metal tubes more than 15 degrees when tried with the fingers- - - - - - - - - Minor

d. Excess cement. Excess cement protruding more than 0.031 inch (.79 mm) from edge of cap with contact diameter of 0.375 inch (9.53 mm) or less, or more than 0.062 inch (1.57 mm) from edge of cap with contact diameter more than 0.375 inch (9.53 mm) - - - - - Minor

e. Dents.

(1) Any dent more than 0.031 inch (.79 mm) in depth- - - - - - - - - Minor

(2) More than two dents greater than 0.010 inch (.25 mm) in depth- Minor

f. Welds. Any missing welds - Minor

40.4 Lead defect classification.

a. Unconnected. Except where intended - - - - - - - - - - - - - - - - - - Major 1

b. Condition.

(1) Leads knotted or severely kinked - - - - - - - - - - - - - - - - - Control

(2) Frayed leads (stranded conductors). More than 10 percent of the strands broken- Major 1
Note: The free ends of broken strands shall be removed.

40.5 Internal defect classification.

40.5.1 Spot welding. Broken, open or not welded - - - - - - - - - - - - - Major 1

40.5.2 Cracked micas. Cracked through, except for bumper point- - - - - - Control

40.5.3 Plates fused. In the active area of the plate, fused or incipient melting (holes or blisters) due to bombardment- - - - - - - - - - - Control

40.5.4 Getter area. Getter not flashed; getter missing or detached- - - - Major 1

40.5.5 Getter peel. Peeled or blistered more than 0.031 inch (.79 mm) in longest dimension for subminiature tubes, and 0.062 inch (1.57 mm) in longest dimension for all other tubes - Minor

40.5.6 Loose particles in any part of finished tube.

* 40.5.6.1 Application. In addition to the criteria specified in 40.5.6.2 through 40.5.6.4, the following paragraphs specify applicable revised criteria for the particular tube family indicated:

Type of tube	Paragraph
Miniature and subminiature receiving	50.4.2
Transmitting and power rectifier	60.2.5

Note: Tubes with debatable particles shall remain in the sample and shall be subjected to the particles indicator test, method 1206.

40.5.6.2 Nonconducting particles.

a. Micas.

(1) Any single particle more than 0.375 inch (9.53 mm) in longest dimension- Minor

(2) More than five of the mica particles more than 0.031 inch (.79 mm) in longest dimension- Minor

b. Other nonconducting particles.

(1) Any single particle more than 0.125 inch (3.18 mm) in longest dimension- Minor

(2) More than three of the particles greater than 0.016 inch (.41 mm) in longest dimension- Minor

40.5.6.3 Conducting particles. Any particle whose largest dimension is more than three-fourths of the design minimum interelement spacing (except heater cathode) or 0.016 inch (.41 mm), whichever is greater, but in any case, not more than 0.062 inch (1.57 mm)- Major 2

40.5.6.4 Debatable particles. Loose particles that cannot be seen or that by visual means alone cannot be determined to be of a conducting or nonconducting nature. If a decision on acceptance or rejection cannot be made, the individual tube in question shall be subjected to the particles-indicator test, method 1206 - Major 2

40.6 Missing or incorrect marking. Etch or brand is incorrect, or not legible - Major 1

Note: When impractical to etch or brand the tubes during manufacturing processes because of production techniques, this inspection shall be performed after the permanence of marking test (method 1105) when applicable, and at any time after final marking in accordance with 3.6 has been completed.

40.7 Vacuum seal (metal-to-glass) defect classification.

40.7.1 Copper-to-glass feather-edge seals.

a. Color.

(1) Black seals and seal colors outside range of light straw to deep red, inclusive (and brownish green for code 7052 glass) - Major 1

(2) Nonacceptable color more than 25 percent of the seal width, or 0.062 inch (1.57 mm), whichever is less - - - - - - - - - - - - - Minor

b. Shale, (parting of the glass and the metal). Width of shale more than 25 percent of the seal width - Major 1

c. Cracks. Spent external circumferential or moon cracks more than 25 percent of the seal width from the glass edge, or more than 0.094 inch (2.39 mm), whichever is less - - - - - - - - - - - - - - - - - Major 1

d. Bubbles.

(1) Loss of seal width due to bubbles is more than one-third - - - - - Minor

(2) Any single bubble more than one-sixth of the seal circumference- Minor

(3) Combined length of all bubbles more than one-third of the seal circumference - Minor

e. Combinations. A combination of the above defects is more than 33 percent of the seal width- Major 1

f. Splits in feather edge. Any split more than 25 percent of the seal width- Minor

40.7.2 Fernico-, Kovar-, or Rodar-to-glass seals.

a. Cylindrical-edge-type seals.

(1) Color. Less than 0.062 inch (1.57 mm) of the seal width has a color ranging between metallic gray and dark gray- - - - - Minor

Note: This criterion does not apply to seals which are plated prior to glassing; for example, chrome-, gold-, or silver-plated seals.

(2) Bubbles.
(a) Loss of seal width due to bubbles is more than one-third - Minor

(b) Any single bubble more than one-sixth of the seal circumference - Minor

(c) Combined length of all bubbles more than one-third of the seal circumference- Minor

(3) Shale. Width of shale more than 25 percent of the seal width- Major 1

(4) Cracks. Spent external circumferential or moon cracks more than 25 percent of the seal width from the glass edge, or more than 0.094 inch (2.93 mm), whichever is less- - - - - - - Major 1

(5) Splits in metal edge. Any split more than 25 percent of the seal width - Minor

b. Disc- and window-type seals.

(1) Shale. Width of shale more than 25 percent of the seal width, on seals 0.125 inch (3.18 mm) or more in width- - - - - - Minor

(2) Cracks. Spent external circumferential or moon cracks within 25 percent of the seal width from the glass edge, or 0.062 inch (1.57 mm), whichever is less, on seals 0.125 inch (3.18 mm) or more in width, shall be accepted.

(a) All other cracks on seals 0.125 inch (3.18 mm) or more in width - Major 1

(b) Any degree of cracks on seals less than 0.125 inch (3.18 mm) in width- Major 1

(3) Bubbles.

(a) Any bubble more than 0.031 inch (.79 mm) in maximum dimension on seals less than 0.125 inch (3.18 mm) in width - Minor

(b) Any bubble more than 0.062 inch (1.57 mm) in maximum dimension on seals 0.125 inch (3.18 mm) or more in width - Minor

(c) Distance between bubbles of 0.016 (.41 mm) to 0.031 inch (.79 mm) in maximum dimension is less than 0.016 inch (.41 mm) on seals less than 0.125 inch (3.18 mm) in width - Minor

(d) Distance between bubbles of 0.031 (.79 mm) to 0.062 inch (1.57 mm) in maximum dimension is less than 0.016 inch (.41 mm) on seals 0.125 inch (3.18 mm) or more in width - Minor

(e) Cluster of bubbles of any size causes loss of seal width of 33 percent or more - - - - - - - - - - - - - - - - - Major 1

(4) Color. Less than one-third of the seal width has color ranging between metallic gray and dark gray- - - - - - - - - - - - Minor

Note: This criterion does not apply to seals which are plated prior to glassing; for example, chrome-, gold-, or silver-plated seals.

c. Eyelet-to-glass-to-lead seal cracks. Annular cracks which surround the leads (see figure D-2, A) and radial cracks not more than two in number, not extending more than halfway between the lead and inside edge of eyelet, and not deeper then height of glass above eyelet (figure D-2, B), shall be accepted.

(1) Cracks extending across eyelet seal. (See figure D-2, C)- - - Major 1

(2) Shaled seals or seals with cracks which fall outside the above limits - Major 1

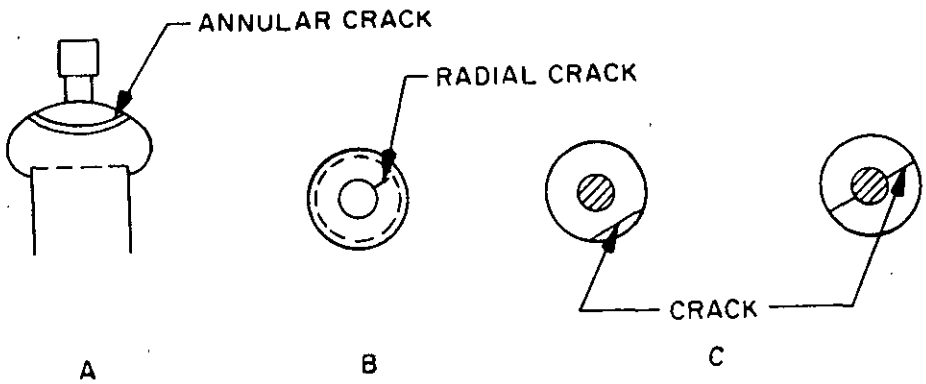


FIGURE D-2. Cracks.

40.7.3 Metallic rod-to-glass seals. Checks in envelope seals with external bosses.

a. Axial check exceeding in depth one-third of length of glass-to-metallic seal - Major 1

b. Radial checks extending more than 0.125 inch (3.18 mm) from the pin - Major 1

40.8 Air-cooled, fin-type radiator defect classification.

40.8.1 Solder obstruction. Solder between the fins completely around the edge of the envelope and inside the circumference of the outer shell up to 0.031 inch (.79 mm) or five percent of the fin width, whichever is greater. In addition, 10 percent of the spaces between the fins may be filled with solder up to 25 percent of the radial fin width - - - - - - - - - Control

Note: Fillets shall be accepted at all corners.

40.9 Surface conditions of die-cast aluminum sheating. Sizes of flaws such as chipouts, unfilled areas, and blow holes shall conform to the limits specified in 40.9.1. The filling material for such flaws shall be approved by the magnet user.

40.9.1 Limits.

a. Blow holes less than 0.030 inch (.76 mm) in diameter shall be accepted.

b. The maximum acceptable dimension (except as indicated for periphery of a cast or machined hole) of any defect, regardless of plug size specified, shall be 0.375 inch (9.53 mm). In areas other than the periphery of cast or machined holes provided for assembly or mounting purposes, blow holes shall not accept a gage of the maximum size or appear with greater frequency than is indicated in the following:

(1) Not more than five flaws 0.045 inch (1.14 mm) to 0.094 inch (2.39 mm), in a 0.500-inch (12.70 mm) diameter circle.

(2) Not more than 10 flaws 0.030 inch (.76 mm) to, but not including, 0.045 inch (1.14 mm), in a 0.500-inch (12.70 mm) diameter circle.

(3) Not more than a combination of 10 of the above flaws in a 0.500-inch (12.70 mm) diameter circle.

c. The maximum acceptable dimension of any defect occuring in the periphery of a cast or machined hole provided for assembly or mounting use, regardless of plug size specified, shall be 0.187 inch (4.75 mm). Not more than two defects shall appear in any periphery of a cast or machined hole.

d. Any defect capable of accepting the maximum plug gage listed shall be filled, and the filler surface shall be made to conform to the shape of the adjacent surfaces.

e. Die-casting-holding-pin depressions, approximately 0.250 inch (6.35 mm) in diameter, uniform in size and location, shall be accepted.

f. Separation of aluminum cover and magnet shall not exceed 0.031 inch (.79 mm) where visible or exposed.

* 50. ADDITIONAL CRITERIA FOR MINIATURE AND SUBMINIATURE RECEIVING TUBES

50.1 Instructions. Internal and external defects shall be combined. A 10-power magnification shall be used for the defects described in the following paragraphs of this appendix:

40.1.8	50.3.2	50.4.2
40.5.1	50.3.3	50.4.3
40.5.2	50.3.4	50.4.5.1
50.2.1	50.4.1	

The requirements of 40. to 40.6, inclusive, of this appendix, shall be supplemented or amended by the requirements of 50.2 to 50.4.5.2, inclusive, of this appendix. Debatable tubes (tubes which cannot be determined to conform to any criteria of 40.1.4 to 40.1.8, inclusive, or 50.2.1 or 50.4.3 of this appendix) shall be subjected to the envelope strain test specified in method 2126. A tube passing the envelope strain test shall be considered acceptable under the visual inspection paragraph for which the tube was originally questioned. A tube failing the envelope strain tests shall be classified a defective under the visual inspection paragraph for which the tube was originally questioned.

50.2 Glass envelopes.

50.2.1 Chipped-out sections on external surface. Any chips deeper than 0.010 inch (.25 mm), or more than 1-1/2 mm in maximum dimension on the straight portion of the bulb, or on the header- - - - - - - - - - - - - - - - Minor

50.2.2 Re-entrant exhaust tip. Re-entrant depth more than one-third of the tip diameter - Minor

50.2.3 Seals.

50.2.3.1 Blisters in dumet seals. Total length of blister-free seal less than twice the dumet wire diameter - - - - - - - - - - - - - - - - - - Minor

50.2.3.2 Size. Tube does not fit applicable outline gage- - - - - - - - Control

50.3 Leads.

50.3.1 Missing pins or leads - Major 1

50.3.2 Corrosion (header and leads). Any corrosion of material causing a leakage path on the header, or any corrosion in the lead recesses of the header or on the leads- Minor

50.3.3 Burned dumet leads. Copper sheath has been burned through outside of the envelope - Minor

50.3.4 Tinning defects.

a. Tinning splashes. Foreign material adhering to the outside surface, or globules of tin adhering to the header of the untinned portion of the leads - Minor

b. Inadequate tinning. Bare spot encircling lead, or any spot 0.04 inch (1.0 mm) long or more, except within 0.05 inch (1.3 mm) or more than 1.50 inches (38.1 mm) from glass- - - - - - - Control

c. Excessive tinning. Maximum lead diameter is more than that specified on the outline drawing from 0.05 (1.3 mm) to 0.25 inch (6.4 mm) from the base of the tube; or the lead diameter from 0.25 inch (6.4 mm) to 1.5 inches (38.1 mm) from the base of the tube is more than the maximum diameter by 0.021 inch (.53 mm). A micrometer shall be used for measurement - - - - - - - - - - - - - - - - - - - Minor

d. Lumpy tinning. Lumpy tinning shall be accepted if the lead diameter in individual spots is not more than one and one-half times the bogey lead diameter - Control

e. Incomplete tinning. Tinned portion of the lead does not extend to within 0.05 inch (1.3 mm) of the header- - - - - - - - - - - - - - - Minor

50.4 Internal defect classification.

50.4.1 Welds (other defects). Either element of a weldment reduced by more than one-half of its formed cross-sectional area, or splash from weld present on any element other than in original weld area - - - - - - - - - - - - Control

50.4.1.1 Weldments (detached). Weldments that become detached - - - - - - Major 1

50.4.2 Loose particles.

50.4.2.1 Procedure. All tubes shall be tapped in an upright position by standard tapping procedure (specified in method 1201). Immediately after tapping, the tube shall be visually inspected for loose particles by rotating it about the main axis in a horizontal position. Tubes with debatable particles shall remain in the sample and shall be subjected to the particles indicator test, method 1206.

50.4.2.2 Nonconducting particles. Loose particles with a maximum dimension of more than 0.062 inch (1.57 mm) - - - - - - - - - - - - - - - - - - - Minor

50.4.2.3 Conducting particles.

a. Subminiature tubes. Loose particles with a maximum dimension of more than three-fourths of the nominal minimum interelement spacing (except heater cathode) or 0.003 inch (.08 mm), whichever is greater - Major 2

b. Miniature tubes. Loose particles with a maximum dimension greater than 0.016 inch (.41 mm)- - - - - - - - - - - - - - - - - - Major 2

50.4.2.4 Debatable particles. Loose particles that cannot be seen or that by visual means alone cannot be determined to be conducting or nonconducting. If a decision on acceptance or rejection cannot be made, the individual tube in question shall be subjected to the particles indicator test, method 1206 - Major 2

50.4.2.5 Dangling particles or slivers. Dangling particles or slivers which are firmly attached shall be accepted. Debatable tubes shall be subjected to the particles indicator test, method 1206. The tube shall be considered acceptable if the particle is still attached at the conclusion of the particles indicator test- - - - - - - - - - - - - - - - Major 2

50.4.3 Metal touching envelope. Metal parts of particles touching the envelope as identified by a white spot or check appearing in the glass (unless specifically intended by design)- Major 1

50.4.4 Missing points on mica. More than 25 percent of mica points on any mica that supports the tube structure - Control

50.4.5 Heater coating defects.

50.4.5.1 Chipped or cracked coating.

a. Heater coating on heater or heater legs missing or damaged exposing bare heater wire to within 0.020 inch (.51 mm) of entrance to cathode sleeve- Minor

b. Heater coating missing 0.020 inch (.51 mm) from the cathode or beyond exposing bare wire length exceeding the diameter of the coated heater wire - Control

c. Heater coating missing or exposing bare wire, length exceeding the diameter of the coated heater wire, when bare heater wire is contained within the cathode sleeve - - - - - - - - - - - - - - Minor

50.4.5.2 Uncoated heater wire. Uncoated heater wire exceeding 0.062 inch (1.57 mm) measured from perimeter of weld toward the cathode - - - - - - - - Minor

50.4.6 Getter defects.

a. Getter peel. Peeled or blistered larger than 0.031 inch (.79 mm) in longest dimensions - Minor

b. Getter area. Getter flash covers an area of less than 0.062 square inch (1.57 square mm)- Minor

c. Burned getter. Getter burned through - - - - - - - - - - - - - - - - - - Major 2

50.4.7 Spacing. Spacing less than 0.010 inch (.25 mm) between elements, supports, etc., outside of the mount spacers, except where specifically intended by design- Minor

50.4.8 Cathode tabs. Any evidence of tear or crack in cathode tab occurring below the cathode weld- Minor

50.4.9 Mica coating. Clear mica path connecting any two adjacent elements exceeding in width the dimension of the smaller element (where coating is intended)- Minor

60. ADDITIONAL CRITERIA FOR TRANSMITTING AND POWER RECTIFIER TUBES

60.1 Instructions. Paragraphs 30. to 40.8, inclusive, of this appendix, as applicable, shall be supplemented or amended by 60.2 to 60.2.5.2, inclusive, of this appendix, as applicable.

60.2 Internal defect classification. During the inspection of glass envelope tubes, the class of defect shall be determined in accordance with the following criteria:

60.2.1 Metal touching envelope. Metal parts touching the envelope unless specifically intended by design- Major 1

60.2.2 Anode coating. Alloying of anode coating with anode basic material over 10 percent of the anode area as evidenced by shiny surfaces. Chipping or flaking of anode coating over 10 percent of the anode area- - - - - - Minor

60.2.3 Welds (other defects). An element of a weldment reduced by more than one-half of its formed cross-sectional area - - - - - - - - - - - - - - - - - - Control

60.2.4 Alinement of parts. Tubes with misalined internal parts shall be accepted providing they pass other specified electrical and mechanical tests and inspections - Control

60.2.5 Loose particles.

a. With tube in an upright position, tap in accordance with procedure and tapping device specified in method 1201 for other than receiving tubes.

Note: In cases where the tap test is impractical due to design of application of the tube, for example, weight, size, mercury content, or operating position, the tapping may be omitted.

b. After tapping, the tube shall be inspected for nonadhering particles by holding the tube in one hand with the dome approximately 45 degrees below horizontal position and strike lightly, three times on the fingertips of the other hand. The tube shall then be rotated about its main axis and inspected for loose particles.

60.2.5.1 Power rectifier tubes.

a. Conducting particles. Two or more conducting particles, each having a dimension not greater than 0.031 inch (.76 mm) - - - - - - - Major 1

b. Nonconducting particles. Four or more nonconducting particles, each having a dimension not greater than 0.062 inch (1.57 mm) - - - - Minor

60.2.5.2 Other transmitting tubes.

a. Conducting particles. Any particle whose largest dimension is more than three-fourths of the design minimum interelement spacing (except heater cathode) or 0.016 inch (.41 mm), whichever is greater, but in any case, not more than 0.062 inch (1.57 mm)- - - - Major 2

b. Nonconducting particles.

(1) Glass slivers in tubes with metal-glass ring seals. Any tube containing loose slivers where two or more slivers, each exceeding 0.156 inch (3.96 mm) longest dimension for seals 1.500 inch (38.10 mm) diameter or smaller, or three or more slivers each exceeding 0.250 inch (6.35 mm) longest dimension for seals larger than 1.500 inch (38.10 mm) diameter - Minor

(2) Tubes without metal-glass ring seals. Any tube containing loose nonconducting particles, exceeding 0.125 (3.18 mm) inch longest dimension in envelopes 2.500 inches (63.50 mm) diameter or smaller or exceeding 0.188 inch (4.78 mm) longest dimension in envelopes over 2.500 inches (63.50 mm) diameter - - - - - - - Minor

(3) Loose emission coating. Any tube containing three or more loose emission coating flakes, each exceeding 0.062 inch (1.57 mm) in longest dimension for tubes with filament power up to 40 watts, or five or more flakes, each exceeding 0.062 inch (1.57 mm) longest dimension for tubes with filament power of 40 watts or over- Minor

70. ADDITIONAL CRITERIA FOR CATHODE-RAY TUBES

70.1 Instructions. Paragraphs 30. to 40.8 inclusive, of this appendix, as applicable, shall be supplemented or amended by 70.2 through 70.3 of this appendix. These criteria apply to tubes of questionable quality only.

* 70.2 Screen and faceplate defects evaluation and classification. All screen and faceplate glass defects shall be classified as major 1 defects and assigned a group number.

a. Classification of screen and faceplate glass defects. All screen and faceplate glass defects shall be classified into one of the following groups:

Group 1 - - - - - - - - - - - Dead spots
Group 2 - - - - - - - - - - - Shaded or mottled area
Group 3 - - - - - - - - - - - Face contour variations
Group 4 - - - - - - - - - - - Surface blemish
Group 5 - - - - - - - - - - - Color spot (cathode-ray tubes only)

b. Examples of common defects and applicable group numbers are as follows:

Defect	Group
Blister (except that clear buried or unbroken surface blisters which meet the requirements of 70.2.4 of this appendix shall not be considered as defects)	1
Bruise or bruise check	1
Bull's-eye top	3
Carbonized mold (or plunger)	4
Chill wrinkle	4
Cold glass	4
Color spot	5
Color streak	2
Cord	4
Dirt on mold (or plunger)	1
Impact mark (outside surface)	4
Lap (inside surface)	4
Loading mark	2
Mold mark	2
Oil spot	4
Rust, rouge, or scale	1
Spew	2
Stone or embedded dirt	1
Suck-up or rundown	3

70.2.1 Spot defects.

a. Maximum sizes of nonelongated spots. Spots which are not elongated and are less than the dimensions specified below shall be acceptable:

Type of spot	Inch
Dead	0.015 (.38 mm)
Bright	.015 (.38 mm)
Color	.040 (1.02 mm)

Spots which are not elongated and are more than the dimension specified above shall be assessed in accordance with tables D-IV, D-V, and D-VI.

b. Elongated spots.

(1) Elongated spots of any length whose maximum width is 0.010 inch (.25 mm) or less will be acceptable.

(2) Elongated spots between 0.010 (.25 mm) and 0.020 inch (.51 mm) in width whose length is 0.500 inch (12.70 mm) or less shall be included in the assessment of the total number of spots in accordance with tables D-IV, D-V, and D-VI. A tube shall be considered defective if it has elongated spots between 0.010 (.25 mm) and 0.020 inch (.51 mm) in width and more than 0.500 inch (12.70 mm) in length.

(3) The diameter of elongated spots whose width is more than 0.020 inch (.51 mm) shall be taken as half of the sum of the length and width. The resultant diameter shall be assessed in accordance with tables D-IV, D-V, and D-VI.

c. Size, number, and separation of spot defects. A tube shall be considered defective if the size and number of spots are more than, or the separation of spots is less than, the values specified in tables D-IV, D-V, and D-VI.

TABLE D-IV. Acceptable spots (envelopes up to 7-1/2 inches in diameter or diagonal).

Type of spot	Maximum diameter		Number in one tube	Of which not more than	Are more than		Minimum separation	
	Inch	mm			Inch	mm	Inch	mm
Dead (blown envelopes)	0.060	1.52	15	7	0.030	.76	0.250	6.35
Dead (pressed-face envelopes)	.040	1.02	15	5	.030	.76	.250	6.35
Bright	.040	1.02	6	2	.030	.76	.250	6.35
Color	.060	1.52	10	2	.050	1.27	.250	6.35

TABLE D-V. Acceptable spots (envelopes 7-1/2 to 17 inches in diameter or diagonal).

Type of spot	Maximum diameter		Number in one tube	Of which not more than	Are more than		Minimum separation	
	Inch	mm			Inch	mm	Inch	mm
Dead	0.080	2.03	25	12	0.040	1.02	0.500	12.70
Bright	.060	1.52	9	2	.050	1.27	.500	12.70
Color	.080	2.03	16	2	.060	1.52	.500	12.70

(1) Zones for rectangular envelopes 17 inches or more diagonal. Faces of rectangular envelopes whose diagonals are more than 17 inches are divided into three zones, all centered on and alined with the tube faceplate. Zone A is the central rectangle, zone B is a larger rectangle excluding zone A, and zone C is the area between zone B and the edge of the minimum useful screen (i.e., quality area). Sizes of zones A and B are as follows:

Envelope diagonal	Zone A	Zone B
Inches	Inches	Inches
17	5 x 7	10-1/4 x 11-1/4
20	6 x 8	11-1/2 x 13-1/4
21	6 x 8	11-1/2 x 14
24	7 x 9	13 x 15-1/2
27	10 x 12	15 x 18-1/2

TABLE D-VI. Acceptable spots (rectangular envelopes more than 17 inches diagonal).

Type of spot	Zone A		Zone B		Zone C		Total no. in one tube	Minimum separation 1/	
	Max dia	No.	Max dia	No.	Max dia	No.			
	Inch mm		Inch mm		Inch mm			Inch	mm
Dead- - -	0.040 1.02	5	0.060 1.52	7	0.080 2.03	10	18	1	25.4
Bright- -	.040 1.02	2	.060 1.52	5	.070 1.78	6	12	1	25.4
Color - -	.060 1.52	6	.070 1.78	9	.080 2.03	12	20	1	25.4

1/ Any spot 0.030 inch (.76 mm) or less in diameter may be as close as 1/2 inch (12.7 mm) to any other spot.

70.2.2 Shaded or mottled areas. All degrees shall be accepted in which the fluorescent and, when applicable, phosphorescent characteristics are as specified, and in which there is not more than a two-to-one variation in any of these characteristics between the mottled or shaded areas and the surrounding unaffected area. A tube shall be considered defective if scum or spew is present whose length is more than 20 percent of the screen diameter or diagonal.

70.2.3 Face-contour variations. A tube shall be considered defective if face-contour variations are present which cause total internal reflection of light (for example, if the area looks black) when viewed at an angle of 30 degrees to the normal of the face surfaces at the point where the face-contour variation occurs.

70.2.4 Inside and outside surface blemishes. All degrees shall be accepted which are not visible to the unaided eye when viewed along the axis of the tube from a distance of three times the screen diameter or diagonal, or 12 inches, whichever is greater. Visible blemishes shall be classified as dead spots and shall conform to the requirements specified in tables D-IV, D-V, and D-VI.

70.2.5 Scratches.

a. A scratch of any length whose width is less than 0.002 inch (.05 mm) shall be accepted.

b. A tube having scratches of 0.002 (.05 mm) to 0.005 inch (.13 mm) in width whose combined total length is more than 2 inches (50.8 mm) shall be considered defective.

c. A tube having scratches of 0.005 (.13 mm) to 0.010 inch (.25 mm) in width whose combined total length is more than 0.500 inch (12.70 mm) shall be considered defective.

d. A tube having any scratches whose width is more than 0.010 inch (.25 mm) shall be considered defective.

70.2.6 Shear marks. A tube shall be considered defective if any outside shear marks are present in the useful screen area.

70.3 Envelope defects. All defects which fail to meet this criteria shall be classified as major 1 defects.

a. For elliptical defects in the form of stones, glass knots, bruises, and scales, the following equivalent diameter formula shall be used:

$$\text{Equivalent diameter} = \frac{\text{length} + \text{width}}{2}$$

b. All blisters, stones, glass knots, bruises and scales less than 0.030 inch (.76 mm) in diameter shall be accepted.

(1) Blisters.

(a) Open blisters. An envelope shall be considered defective if more than three open surface blisters are present which are more than 0.095 inch (2.41 mm) in diameter. This shall apply to envelopes of any size.

(b) Buried or unbroken blisters. An envelope shall be considered defective if the size and number of unbroken blisters are more than the values specified in table D-VII.

TABLE D-VII. Acceptable unbroken blisters.

Tube diameter	Blister size		Maximum number of blisters in any 2-inch (50.8 mm) diameter circle	Of which not more than	Have a length more than
	Maximum diameter	Elliptical limits			
Inches	Inch	Inches			Inch
1 to 3, incl	0.095	0.030 x 0.187 or 0.062 x 0.125 or 0.016 x 0.281	11	3	0.062
Over 3 to 5-1/2, incl	0.187	0.125 x 0.281 or 0.062 x 0.500 or 0.031 x 0.750 or 0.016 x 1.000	11	3 and 2	0.062 and 0.500
Over 5-1/2 to 7, incl	0.312	0.250 x 0.500 or 0.125 x 1.000	11	3 and 2	0.250 and 0.500
Over 7	0.375	0.250 x 0.750 or 0.125 x 1.250	11	3 and 2	0.312 and 0.750

(2) Stones. An envelope shall be considered defective if stones exceed the following dimensions:

(a) More than 0.078 inch (1.98 mm) in diameter in envelopes up to and including 7 inches in diameter.

(b) More than 0.130 inch (3.30 mm) in diameter in envelopes over 7 inches in diameter.

(c) Exposed (not glazed over) stones more than 0.030 inch (.76 mm) in diameter on the outside glass surface.

(3) Glass knots. An envelope shall be considered defective if glass knots are more than 0.187 inch (4.75 mm) in diameter and if glass knots of any size protrude more than 0.030 inch (.76 mm).

(4) Bruises. An envelope shall be considered defective if bruises are more than 0.050 inch (1.27 mm) in diameter.

(5) Scale. An envelope shall be considered defective if scale exceeds the following dimensions:

(a) More than 0.030 inch (.76 mm) in diameter in envelopes up to and including 7 inches in diameter.

(b) More than 0.062 inch (1.57 mm) in diameter in envelopes over 7 inches in diameter.

(6) Cracks and checks. An envelope shall be considered defective if any cracks or checks are present.

(7) Chips. An envelope shall be considered defective if any unglazed chips are present.

(8) Scuff. An envelope shall be considered acceptable if scuff is present.

(9) Scratches. An envelope shall be considered defective if scratches exceed the following dimensions:

(a) Between 0.002 (.05 mm) and 0.004 inch (.10 mm) in width that are more than 2 inches (50.8 mm) in length.

(b) Between 0.004 (.10 mm) and 0.006 inch (.15 mm) in width that are more than 0.500 inch (12.70 mm) in length.

(c) More than 0.006 inch (.15 mm) in width.

(10) Radius lap and outside shear marks. Radius lap and outside shear marks shall be accepted.

(11) Finish. Splice contours shall be as smooth and as free from sharp reentrant angles as good commercial practice permits.

PROCEDURES FOR APPLYING FOR QUALIFICATION OF A PRODUCT

10. SCOPE

10.1 Scope. This appendix establishes the procedures required of contractors for applying for qualification of a product. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

20.1 Government standard and handbook. Unless otherwise specified, the following standard and handbook of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this appendix to the extent specified herein.

STANDARD

MILITARY

MIL-STD-45662 - Calibration System Requirements.

HANDBOOK

MILITARY

MIL-HDBK-52 - Evaluation of Contractor's Calibration System.

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

20.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this appendix to the extent specified herein.

PUBLICATION

SD-6 - Provisions Governing Qualification.

(Copies may be obtained upon application to Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.)

20.3 Order of precedence. In the event of a conflict between the text of this appendix and the references cited herein, the text of this appendix shall take precedence.

30. APPLICATION FOR QUALIFICATION TESTING OF PRODUCTS COVERED BY COORDINATED MILITARY SPECIFICATIONS (see 4.2)

30.1 General instructions.

30.2 Application for qualification testing. One copy of a request to commence qualification testing should be forwarded to the preparing activity for the product required.

a. The request to commence qualification testing must clearly indicate the specific product, or products, and the governing Government specification (title and number).

b. Several products covered by the same specification may be included on one request; however, separate requests must be made for products covered by different specifications.

30.3 List of qualification test facilities. The manufacturer shall submit lists of qualification test facilities for in-plant qualification testing as required by DoD Publications SD-6, "Provisions Governing Qualification". The items on the lists will be reviewed by Government engineers to determine adequacy for their intended purpose before being used for qualification tests. One copy of a list of qualification test facilities is to be prepared and forwarded to the preparing activity.

(NOTE: If Government engineers have previously found a manufacturer's plant acceptable for qualification testing under a particular specification and if no changes in facilities have occurred, then only a request to commence qualification testing is required. Manufacturers need not submit an additional request with subsequent applications under the same specification for the same plant unless specifically requested to do so by the preparing activity.)

The qualification test facility lists to be submitted are categorized as follows:

a. Calibration standards list. The calibration standards list shall contain all primary standards and precision measurement equipment used as reference or transfer standards in the in-plant calibration program. (Certificates showing traceability to the National Bureau of Standards (NBS) are to be maintained current at the manufacturer's plant and available at the time of inspection.)

b. Specification list. The specification list shall include all test and measurement equipment which is used in the qualification testing under the specific specification. If a master list is used, (see 30.3c of this appendix) the equipment listed on the master list need only be referenced on the specification list. Specification lists require each item of test equipment to be cross referenced to the applicable qualification test paragraph of the specification. The test paragraphs will be listed in the order of appearance in the qualification test table of the applicable specification. As nearly as practicable, equipment used collectively to perform the tests, or make certain measurements, will be grouped together on the lists. Meters that are not an integral part of the test equipment will be listed separately. Where tests are repeated in ensuing subgroups of the qualification table, the complete relisting of test equipment for that test is not necessary. An annotation, "see (applicable paragraph) above" will suffice.

c. Master list. This list is optional and is generally used when a manufacturer wishes to list all equipment that will be used for qualification to more than one specification or for a specification such as MIL-E-1 which has many detailed sheets. Master lists will be prepared in sections to relate the equipment to the appropriate types of test, such as, electrical test facilities, mechanical test facilities, environmental test facilities, and reference and transfer standards.

Complete schematic diagrams and descriptive literature concerning the mechanical and electrical design features of all nonstandard, noncommercial and nonmilitary (homemade) test equipment will accompany the appropriate list.

30.4 Drawings. One copy of an engineering drawing, cross section drawing, annotated sketch, or other suitable outline showing details and description of the product to be tested is to be included with the application.

30.5 Calibration system description. A copy of the company calibration system description in accordance with the latest issue of MIL-STD-45662 must be submitted prior to an inspection of facilities, preferably with the initial application.

40. INSPECTION OF MANUFACTURER'S PLANT BY THE PREPARING ACTIVITY

40.1 General instructions.

a. Upon receipt of the above information, Government engineers will determine whether an inspection of the manufacturer's test facilities will be required prior to authorizing qualification testing or whether, on the basis of prior knowledge, qualification testing may be authorized without an inspection.

b. If an inspection of the test facilities is required, the preparing activity will inform the manufacturer of the date that the facilities are to be inspected. The manufacturer will have his proposed test equipment in operating condition and his test personnel, certificates, and records of calibration available at the time of the facilities' inspection. Certificates of calibration for the reference standards are to be obtained by the manufacturer from the National Bureau of Standards (NBS), the original equipment manufacturer, or an acceptable independent calibration laboratory. Transfer standards may be calibrated by the manufacturer. Dates of calibration, historic charts, and/or graphs are to be maintained and available. All calibration standards and all equipment used for qualification testing must have been calibrated within one year of the initiation of tests or more frequently as required. Calibration systems will be evaluated against the requirements of the latest revision of MIL-STD-45662. The calibration system description shall provide a complete detailed plan for monitoring the accuracy of every item of measuring and test equipment and every measurement standard utilized in qualification testing. A method, procedure, or standard practice must be prescribed for the satisfaction of each applicable requirement of the latest revision of MIL-STD-45662. MIL-HDBK-52 is used for evaluation of the calibration system.

c. A resume of the pertinent education and experience for the personnel associated with qualification testing at the manufacturer's plant will be made available to the visiting Government inspection personnel.

d. The manufacturer will be informed by the preparing activity of the results of the facilities' inspection as follows:

(1) If the results are favorable, the manufacturer will be issued a letter granting suitability status to his facilities.

(2) If the results are unfavorable, the manufacturer will be informed as to the reasons why and what corrective measures are necessary on his part before a letter of suitability will be issued, and qualification testing authorized.

50. APPLICATION FOR QUALIFICATION TESTING OF PRODUCTS COVERED BY LIMITED COORDINATED MILITARY SPECIFICATIONS

50.1 General instructions. The manufacturer should apply to the qualifying activity or cognizant military service concerning any deviation from 30. and 40. in this appendix.

PROCEDURE FOR CONDUCTING FIRST ARTICLE TESTING

10. SCOPE

10.1 Scope. This appendix establishes the procedure and criteria for invoking first article testing in lieu of qualification. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

20. GENERAL INSTRUCTIONS

a. This procedure provides for first article testing as a replacement for qualification testing whenever there has been a TSS in existence for a long period of time and no source has qualified; or where sources have qualified a product and are nonresponsive to an invitation for bid (IFB), or where procurement is necessary before a source has qualified a product. Then, qualification requirements may be deleted or waived and first article inspection invoked for the acquisition of an item covered by a military specification.

b. The contract must specify the applicable document(s) for first article testing. The sample sizes and acceptance criteria for first article testing shall be as specified in table I of this specification (samples and acceptance criteria for qualification). The first article testing shall commence at the manufacturer's plant after award of the contract, unless otherwise specified. The specimens to be tested shall be representative of the product to be produced for delivery on the contract or purchase order

c. The first article samples shall be forwarded to the contracting agency (or other agencies as designated by the contracting agency) for approval. The tested specimens shall be retained by the contracting agency to serve as a reference standard. Approval of the first article specimens is required prior to delivery of units on the contract. The fabrication of production units prior to approval of the specimens shall be at the manufacturer's risk.

d. Two copies of test reports, photographs, etc., shall be prepared. One copy of each shall be forwarded to the preparing activity or its agent for the specification.

INDEX

INDEX

Custodians:
Army - ER
Navy - EC
Air Force - 85

Review activities:
Army - AR, MI
Air Force - 17, 99
DLA - ES

User activities:
Army - AT, AV, ME, SM
Navy - AS, CG, MC, OS, SH
Air Force - 11, 19

Agent:
DLA - ES

Preparing activity:
Navy - EC

(Project 5960-3335)

*U.S. GOVERNMENT PRINTING OFFICE: 1985-505-038:20839

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document*(s)* or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

Naval Electronic Systems Command
Washington, DC 20363

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

COMMANDER
NAVAL ELECTRONIC SYSTEMS COMMAND
DEFENSE STANDARDIZATION PROGRAM BRANCH
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20363
ATTN: ELEX 8111

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-E-1J	Electron tubes, General specification for

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

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

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.