INSPECTION INSTRUCTIONS FOR ELECTRON TUBES

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ARMED SERVICES ELECTRO STANDARDS AGENCY
FORT MONMOUTH, N.J.

INSPECTION INSTRUCTIONS FOR ELECTRON TUBES
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SECTION

1. SCOPE

1.1 PURPOSE -
This manual is for use in conjunction with Military Specification MIL-E-1B, and presents information pertaining to inspection procedures, sampling plans and criteria for determining the acceptability of those Electron Tubes covered by the above specification and for use by the Armed Services.

By its nature this manual is primarily of interest to electron tube manufacturers and electron tube inspectors.

1.2 REFERENCES -
Provisions of the following specifications of the issue in effect on the date of invitation for bids for any particular contract, shall be considered as a part of the provisions of this manual for that particular contract.

Military Specifications:

MIL-E-1 - Military Specification for Electron Tubes.
MIL-P-75 - Packaging, Packing, and Container Marking-Tubes Electron.

Military Standards

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

MIL-STD-129 - Marking of Shipments

1.2.1 AVAILABILITY OF REFERENCES

MIL-E-1
MIL-P-75

Copies of specifications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer; however Specifications MIL-E-1 and MIL-P-75 may be obtained upon application to the Armed Services Electro Standards Agency (ASESA) Fort Monmouth, N.J.

MIL-STD-105
MIL-STD-129

Copies of these Military Standards may be obtained by directing requests as follows:

For Department of the Army agencies, to Chief of the specified agency or as directed by that agency.

For Department of the Army contractors, to the Contracting Officer.

For Department of the Navy activities, to the Commanding Officer, Naval Supply Center, Norfolk 11, Va.

For Department of the Navy contractors, to the Bureau of Supplies and Accounts, Washington 25, D. C.

For the Marine Corps, to the Quartermaster General, Headquarters, U. S. Marine Corps, Washington 25, D. C.

For Department of the Air Force activities and Air Force contractors, to the Commanding General, Air Material Command, Wright-Patterson Air Force Base, Dayton, Ohio.

Copies of these Military Standards may be obtained for other than official use by individuals, firms, and contractors from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Both the title and the identifying symbol number should be stipulated when requesting copies of Military Standards.

2. DEFINITIONS PERTAINING TO SAMPLING AND SAMPLING PROCEDURES

ACCEPTABILITY - Acceptability is the condition of a lot, governed by its ability to conform with the specification requirements as determined by tests under the applicable sampling plan.

ACCEPTABLE LOT - An acceptable lot is a lot represented by a sample which has met the requirements of the applicable sampling plans.

ACCEPTABLE QUALITY LEVEL - (AQL) The acceptable quality level (AQL) is a nominal value expressed in terms of percent defective or defects per hundred units, whichever is applicable, specified for a given group of defects of a product. (See MIL-STD-105A Par. 4.1)

ACCEPTANCE NUMBER - The acceptance number is a number associated with each sampling plan indicating the acceptability of a lot. If the number of defectives does not exceed the acceptance number, the lot is acceptable. (See MIL-STD-105A pars. 11.1.2, 11.1.3, 11.1.4)

ATTRIBUTES, INSPECTION BY -Inspection by attributes is inspection wherein the unit of product is classified simply as defective or nondefective with respect to a given requirement or set of requirements.

DEFECT - A defect is any deviation of the unit of product from requirements of the specifications, drawings, or purchase descriptions, or from any changes thereto in the contract order. (See MIL-STD-105A par. 2.1)

DISQUALIFICATION - Disqualification is the loss of eligibility to use a given type of sampling plan. This condition requires that a more exacting plan be substituted.

DOUBLE SAMPLING - Double sampling is a type of sampling in which a decision to accept or reject an inspection lot may be reached after one sample from the inspection lot has been inspected, and will always be reached after not more than two samples from that inspection lot have been inspected.

ELIGIBILITY
Eligibility is the status of a manufacturer which enables him to use a given type of sampling plan. Eligibility is generally determined from the process average if it has been established.

FIRST SAMPLE
The first sample is the initial sample inspected from air inspection lot; for single sampling, the First sample is the only sample inspected from each inspection lot.

INOPERATIVE

INSPECTION
Inspection is the process of measuring, examining, testing gaging, or otherwise comparing the unit of product with the applicable requirements. (See MIL-STD-105 par. 1.2)

ITEM
Item is a term used interchangeably with Unit of product.

INSPECTION LOT
The term "lot" shall mean "inspection lot", i.e., a collection of units of product submitted by a supplier for government inspection (MIL-STD-105A, par. 5.1)

INSPECTION LEVEL
Inspection level is a term used to designate the relative amount of inspection given a product. See Sample Size Code Letter and MIL-STD-105A, Par. 10.2 (See par. 5.3.2.6 for additional inspection levels)

MULTIPLE SAMPLING PLAN
Under multiple sampling, the procedure shall be similar to that defined under double sampling except that the number of successive samples required to reach a decision may be more than two. (See MIL-STD-105A, par. 11.1.4)

NORMAL (TESTING PLAN) (INSPECTION)
Normal inspection is a type of inspection performed for a specified AQL and inspection level which is to be used when the process average is not outside the applicable prescribed upper and lower limits. (See MIL-STD-105A par. 9.)

NON-CONFORMING LOT
A non-conforming lot is a lot represented by a sample which has failed to meet the requirements of the applicable sampling plan.

ORIGINAL INSPECTION
Original inspection is the first inspection of a particular quantity of product as distinguished from the inspection of product which has been resubmitted after prior rejection (See MIL-STD-105A, par. 8.1)

PERCENT DEFECTIVE
The percent defective of any given quantity of product is obtained by dividing the number of defective units of product contained therein by the total number of units of product, and multiplying by

one hundred (a unit being considered defective if it contains one or more defects). Expressed as an equation:

$$\text{Percent defective} = \frac{\text{Number of Defectives}}{\text{Number of Units}} \times 100$$

See MIL-STD-105A Par. 3.2

PROCESS AVERAGE

The process average is the average percentage of defective items in the first samples from submitted inspection lots. Usually the number of the lots and/or a time period is specified. In production acceptance sampling, the process average, unless otherwise prescribed, is established by computing the arithmetic mean of the percent defectives in the last 10 consecutive lots, from a minimum of 5 days production. (See MIL-STD-105A, Par. 8.1)

REDUCED INSPECTION

Reduced inspection is inspection under a sampling plan with the same AQL as for normal inspection but requiring a smaller amount of inspection. Reduced inspection is instituted when warranted by past performance under the conditions imposed, and including a consideration of the process average. (See MIL-STD-105A, par. 9.3.3)

REJECTION NUMBER

The rejection number is a number associated with each sample of a sampling plan. An inspection lot is rejected for a class of defectives after inspection of a particular sample if the total number of defectives of that class found in that and all preceding samples of that lot combined, is equal to or greater than the rejection number associated with that sample or samples. (See MIL-STD-105A Pars. 11.1.2, 11.1.3)

SAMPLE

A sample is one or more units of product drawn from a lot, the units of the sample being selected without regard to their quality. (See MIL-STD-105A par. 7.1)

SAMPLE SIZE

Sample size is the number of units of product in a sample. (See MIL-STD-105A par. 10.2)

SAMPLE SIZE CODE LETTER

Relative sample sizes are designated by code letters from A to Q. The sample size code letter depends on the inspection level and the lot size. The sample size code letter applicable to the specified inspection level shall determine the sample size for a given lot size. (See MIL-STD-105A par. 10.2 and Table III therein.)

SAMPLING PLAN

A sampling plan consists of a sample size or series of sample sizes with associated acceptance and rejection numbers, and is used to determine the acceptability of the lot. (See MIL-STD-105A Par. 10.5)

SECOND SAMPLE

In a double or multiple sampling plan, the second sample selected for inspection. (See MIL-STD-105A par. 11.1.3)

SINGLE SAMPLING

Single sampling is a sampling plan in which the lot from which the sample was drawn is accepted if the number of defectives found in

the sample is equal to or less than the acceptance number for the sampling plan. If the number of defectives is equal to or greater than the rejection number for the sampling plan, the lot is rejected. (See MIL-STD-105A Par. 11.1.2)

3. GENERAL PROCEDURES FOR ACCEPTANCE

The contractor will furnish all necessary facilities and equipment for making the tests (except qualification approval tests) and inspection required by the specification and will carry out all tests under the supervision of the Service inspector. The test equipment shall be adequate in quantity to avoid delay during inspection. The Service inspector will ascertain that the tubes, when submitted for inspection, meet all the requirements of the specification and of the tube specification sheet. (The contracting officer reserves the right to make other tests not specifically required when such tests are deemed necessary to determine full compliance with the specification requirements). The manufacturer may make such additional tests as he may deem necessary to insure proper quality control of his product. Other test methods may be substituted for those specified herein, provided a direct correlation between the results of the contractor's test methods and those specified in the specification, can be demonstrated to the contracting officer, and provided that such substitution in no manner relaxes the requirements of the specification. The contractor shall correct all deviations from the specification pointed out by the Service inspectors. The schematic wiring diagrams of the test circuits employed shall be made available for checking by the Service inspector. The Service inspector reserves the right to check the calibration and accuracy of the test equipment at any time. Any tube which fails any test will be rejected and will not be again presented for inspection unless the manufacturer has corrected the cause of failure.

3.1 PRODUCTION TEST ACCEPTANCE SAMPLING

3.1.1 AUTHORIZATION

Production Acceptance Sampling Tests shall be performed in accordance with the provisions of Military Standard MIL-STD-105A. The production tests are identified on the tube specification sheet by the absence of any asterisk or number symbol marking.

3.1.2 GROUPING OF DEFECTS

For the purposes of this manual, defects are divided into three major groupings as follows:

Group A - Mechanical Defects
Group B - Electrical Defects
Group C - Inoperatives (including shorts, discontinuities and air leaks)

3.1.3 ACCEPTABLE QUALITY LEVEL BASIS

The basis for acceptance under this section shall be Acceptable Quality Levels (AQL) as follows:

Group A - 1% for Major; 2.5% for Minor; 10% for Control defects
Group B - 1%
Group C - 0.4%

The degree of defect for Group A Defects (i.e. Major, Minor, or Control) is indicated in the Criteria Sections (Sections 4 and 5) in a column to the right of each defect. Individual tubes shall not be rejected for control defects, however, if the AQL of 10% for such defects in any lot is exceeded, the lot shall be returned to the manufacturer.

3.2 DESIGN TEST ACCEPTANCE SAMPLING

3.2.1 AUTHORIZATION
Design Acceptance Sampling tests shall be performed in accordance with the provisions of MIL-STD-105A.

3.2.2 STANDARD DESIGN TESTS
Tests identified on the tube specification sheet by a single asterisk (*), shall be tested at an inspection level IA and an acceptable quality level basis of 6.5% for each individual test.

3.2.3 SPECIAL DESIGN TESTS
Tests identified on the tube specification sheet by a number symbol (#) shall be tested at inspection level IA and an acceptable quality level basis of 4.0% for each individual test.

NOTE: See Table 5.3-1 for Inspection Level IA.

3.3 MISCELLANEOUS REQUIREMENTS - Unless otherwise specified on the Tube Specification Sheet, tubes shall meet the requirements of the following paragraphs of Specification MIL-E-1B.

PAR. REFERENCES

MIL-E-1B	JAN-1A	INSPECTION INSTRUCTIONS	REQUIREMENT
3.3	C-1		Material
3.4.1	E-4a		Conductors
3.4.2	E-4b		Seal-off Tip
	E-4c	5.10.1.1	Loose Particles in Magnetrons
3.4.3	E-5		Base Connection
3.7	E-7		Marking of Tubes
3.7.1.1	E-6	6.1.1	Designation
3.7.1.2) 3.7.1.3)	E-6a	6.1.2	Designation of Qualification Approved Tubes
	E-6b	6.1.3	Designation of Tubes Not Having Qualification Approval
	E-7a	6.2	Marking of Qualification Approved Tubes
	E-7b	6.3	Marking of Tubes Not Qualification Approved
3.7.1.3	E-7c		Marking of Magnetrons
3.7.4	E-7d(1)		Acceptance Date
3.7.6	E-7d		Additional Markings
3.7.7	E-7d(2)		Manufacturer's Source Code
3.8	C-2		Workmanship
4.9.1	E-4		Mechanical Qualities
4.3	F-1c		Test Conditions

MIL-E-1B	JAN-1A	INSP. INST.	REQUIREMENT
4.4	F-1b		Order of Tests
4.5	F-3		Holding Period
4.5.1	F-3a		Alternate Holding Period Procedure
4.6	F-1d		Preheating
4.6.1	F-1d(1)		Preheating Cathode Ray Tubes
4.7	F-1e		Continuity and Short Tests for Receiving Tubes
4.8	F-2		Insulation of Electrodes
4.9	F-5		Mechanical Tests
4.9.1	F-5a		Mechanical Inspection
4.9.2	F-5d		Dimensions
4.9.2.1	F-5d(1)		Dimensions of Cathode Ray Tubes
4.9.3	F-5b		Brass or Bronze Sleeve Base Test
4.9.4	F-5c		Insulating Quality of Base Material
4.9.5	F-5f		Base, Cap and Insert Test
4.9.8	F-5h		Salt Spray Test
4.9.18	F-6a		Carton Drop
4.9.20.1	F-6b(9a)		Order of Test for Ruggedized Tubes
4.9.20.2	F-6b(9b)		Electrical Characteristics Measured Before and After Shock Tests or Fatigue Tests

3.4 QUALIFICATION APPROVAL

3.4.1 SCOPE - These provisions outline the procedure to be followed by the manufacturers in submitting electron tube samples for qualification tests required by the applicable tube specification sheets. Qualification tests consist of a series of tests performed on sample tubes for the following purposes:

(a) To determine the ability of a manufacturer to fabricate a product in accordance with requirements of the applicable MIL-E-1B specification sheet.

(b) To insure correlation of tests and specification interpretation.

(c) To determine the products' suitability for use by the Armed Services.

Qualification Approval is not restricted to types where required but is encouraged for every type.

Qualification Approval and listing of a manufacturer's name on the Qualified Products List is solely for the convenience of the Armed Services and their contractors in performance of Armed Service Procurement and inspection functions; however, the fact that an electron tube is qualified, in no way guarantees acceptance of the tube by the Armed Services on submittal under a particular contract or order, nor does it release a contractor supplying the tubes, from any obligation to meet completely the requirements of the contract or order.

Armed Services policy prohibits the use of Qualification Approval status for advertising or promotional purposes. Information pertaining to existing approvals shall be used only in connection with procurement and inspection functions by the Armed Services or their contractors.

3.4.2 REQUEST FOR QUALIFICATION APPROVAL

A manufacturer desiring to submit tubes for Qualification Approval test shall address his request directly to:

Director
Armed Services Electro Standards Agency
Fort Monmouth, New Jersey
Attn: Armed Services Electron Tube Committee

3.4.3 INFORMATION TO BE SUBMITTED

Each letter of request shall be in triplicate, shall refer only to one type of tube, and shall incorporate the following information:

3.4.3.1 INFORMATION ON ELECTRON TUBE

(Tube Description Form available form Armed Services Electro Standards Agency, Fort Monmouth, N. J. on request.)

3.4.3.1.1 MANUFACTURER'S TYPE DESIGNATION

The manufacturer's type designation of the tube for which qualification approval is desired as well as any other designations by which the tube may be or has been known.

3.4.3.1.2 MATERIALS AND PERTINENT DESIGN FEATURES

A statement or statements describing the materials and pertinent design features of the tubes, such as anode, grid, base, filament material, construction, etc. This need not be detailed to the extent of manufacturing data, but shall be sufficiently complete to definitely define the particular construction. A copy of this statement shall be retained by the manufacturer and be available to the Service Inspector at the plant.

3.4.3.1.3 CHANGE IN DESIGN OF TUBE TYPES HAVING QUALIFICATION APPROVAL

If resubmission is requested because of changes or improvements in design of an Army-Navy-Air Force type of tube, which has already received qualification approval, the manufacturer shall submit a complete statement describing the changes, the reason(s) therefor and the improvements expected to be accomplished thereby.

3.4.3.2 INFORMATION ON MANUFACTURER

3.4.3.2.1 LOCATION

The location of the plant wherein the electron tube for which approval is sought will be, or is, manufactured.

3.4.3.2.2 ENGINEERING ORGANIZATION

Extent of the applicant's engineering organization.

3.4.3.2.3 PRODUCTION CAPACITY AND FACILITIES

A list of the types of electron tubes produced, production capacity, and normal production of each type of tube for the past two years, and description of the applicant's manufacturing facilities and equipment. If the manufacturer has Service contracts for the tube type being submitted, information regarding the contract number, number of tubes involved in each contract and delivery dates should be furnished to ASESA.

3.4.3.2.4 CERTIFICATION

Submission of a written statement certifying that the following conditions are true, is necessary when the initial submission of electron tube samples for qualification test is made:

The applicant:

a. Is the actual manufacturer of the electron tubes submitted for qualification test.

b. Will no use the results of such a test, or information that test was conducted, for advertising, sales promotion or publicity purposes.

c. Will not apply for a retest of the electron tubes until satisfactory evidence is furnished to the Armed Services Electron Tube Committee that all the defects which were disclosed by the original tests have been corrected.

d. Will furnish under all subsequent Army, Navy, or Air Force contracts or orders, electron tubes equal in every respect to those qualified as a result of qualification test.

e. Will notify the Armed Services Electron Tube Committee of any changes or improvements in design of an Army-Navy-Air Force type of electron tube which has already received qualification approval, together with a complete statement describing the changes, the reasons therefor, and the improvements expected to be accomplished thereby.

Forms for the above certification are available, on request, from Armed Services Electron Tube Committee, Fort Monmouth, N. J.

3.4.3.2.5 INFORMATION PREVIOUSLY SUPPLIED

If the applicant has previously supplied the information outlined in the three preceding paragraphs, statement to this effect will suffice.

3.4.3.2.6 MANUFACTURER'S TEST EQUIPMENT

At the time application is made for authorization to submit samples for qualification approval tests, a statement shall be made of the manufacturer's ability to make the tubes and of the availability of all the necessary test equipment to perform all the required (design and production) MIL-E-1B specification tests. The lack of necessary test equipment (including life test equipment) shall be cause for withholding or suspension of qualification approval until the equipment has been obtained.

3.4.3.2.7 MANUFACTURERS TEST DATA

A complete report of the manufacturer's test, including test conditions, on the sample tubes is required in triplicate. This report shall include all production and design tests of the applicable tube specification sheet, except dimensions. Tests which by their nature tend to destroy or deteriorate the tube, such as life test or cement immersion, shall be performed on tubes other than those submitted for qualification test. Five copies of complete data on life tests, either performed under the cognizance of the Service inspector, or certified by the manufacturer on production tubes of the same design as those samples submitted for qualification test shall be furnished with the request or within 60 days thereafter. Inaccurate or inadequate test data may be cause for refusal of qualification approval.

The number of tubes for which life test data is required will be determined by the group to which the particular tube is assigned on the Tube Specification Sheet as follows:

Group A - 20 tubes
Group B - 10 "
Group C - 5 "
Group D - 3 "

The test report shall refer to each sample tube by a serial number, which shall be marked on the tube and the report in such a manner as to be clearly defined. Duplicate serial numbers shall never be used for the same tube type.

When the Heater Cycling test is specified on the tube specification sheet, Heater Cycling data on 50 tubes shall be submitted by the manufacturer.

3.4.3.2.8 PHOTOGRAPHS OF SAMPLES FOR QUALIFICATION APPROVAL

Five copies of at least one photograph of the completely assembled tube and one tube either without envelope but with the assembly cut open (showing internal construction) or with the parts unassembled (exploded assembly), are required. Three sets of photographs shall be transmitted to ASESA, one set shall be supplied to the Service inspector in charge and one set shall be sent with the sample tubes to the testing laboratory. The prints shall be 8" x 10" in size, depict the tube on as large a scale as practicable, and include the type number, manufacturer, plant of manufacture, place of manufacture and appropriate reference scale, (scale placed in the plane of and parallel to the center line of the tube and tube parts photographed and perpendicular to the optical axis of the camera), and approximate date of forwarding letter. Radiographs may be employed if contributory to the description.

3.4.4 SHIPMENT OF SAMPLES

When the information complies with the above, authorization will be given by letter from ASESA to ship the test samples to a designated laboratory. The sample tubes shall be produced, carefully packed, marked as indicated in the letter of authorization and shipped at the manufacturer's expense to the lab-

oratory designated in the authorization. Sample shipments shall be made at the manufacturer's expense and the samples shall in no way be made the basis of any claim against the government. No shipment of samples is to be made until specific authorization is received.

The shipment shall be accompanied by: a copy of the test data as required in paragraph entitled "Manufacturer's Test Data"; one copy of the photograph(s) as required in paragraph entitled "Photograph of Samples for Qualification Approval"; one copy of the defining features of paragraph entitled "Materials and Pertinent Desing Features". When the tube specification sheet for the tube type requires that a "Bogie" tube (a selected tube having certain specified characteristics) be used in setting or adjusting the test equipment, the manufacturer shall include in the shipment a stabilized bogie tube, except when the tube specification sheet states that the Services will furnish standard tubes. In those instances where the tube specification sheet states that the Services will furnish standard tubes, these tubes may be obtained on a loan basis from the Services by applying to the Armed Services Electro Standards Agency, Attn: Armed Services Electron Tube Committee, Fort Monmouth, N. J. As soon as the sample tubes have been shipped to the designated laboratory, ASESA should be notified of date samples were shipped.

3.4.5 NUMBER OF SAMPLES REQUIRED

3.4.5.1 FOR GENERAL TUBE TYPES

There will be required four samples each of tubes having a unit list price in excess of ten dollars or six samples each of tubes having a unit list price of ten dollars or less. A bogie tube, if required, shall be in addition to the test samples submitted and may be a tube that has been stabilized by life test operation. The sample tubes will be presumed to represent the manufacturer's production product, shall be produced by and at the plant where manufacture is, or is to be, accomplished and shall be selected from current completely processed production.

3.4.5.2 FOR RUGGEDIZED AND RELIABLE TUBES AND TYPES HAVING SPECIAL MECHANICAL TESTS - The following tabulation shows a schedule of tests and samples required.

Request for Samples required for Qualification Approval Tests on Ruggedized or Reliable Tubes

Test	Quantity	Manufacturer to Submit Readings for
a. Electrical	6	All Tests
b. Shock	10	Post Shock Tests
c. Fatigue	6	Post Fatigue Tests
d. Vibration(4.9.20.3) (F-6b(9c))	6	Post Fatigue Tests
e. Vibration(4.9.20.4) 1/(F-6b(9d))	Use "a" samples	
f. Mechanical Resonance	Use "d" samples	
g. Torque	Use "a" samples	
h. Dimensions	Use "a" samples	

1/ See referenced paragraphs in MIL-E-1B

3.4.6 MARKING OF SAMPLE

The marking required in paragraph 3.7.2 through 3.7.7 of MIL-E-1B, for nonapproved tubes shall be marked on the sample tubes by the process and in the manner which the applicant plans to use in production. See Section 6 of this manual.

3.4.7 SAMPLES PROVING UNSATISFACTORY

If the samples submitted prove unsatisfactory, the manufacturer will be so advised and consideration will be given to his request for resubmission after it has been clearly shown that changes have been made in the product with reference to design, method of manufacture, etc., sufficient to warrant additional tests, and the request is made in accordance with the provisions of this section.

3.4.8 AWARD AND REVOCATION OF QUALIFICATION APPROVAL CERTIFICATE

If a review of the Laboratory tests prove the sample tubes to be satisfactory, a qualification approval certificate will be forwarded to the manufacturer along with the test results. This certificate approves for Army, Navy, and Air Force use only such electron tubes as are mechanically and electrically of the same design and construction as those tested. Changes in design, construction or place of manufacture shall invalidate a qualification approval, excepting minor changes which in no way reflect upon Service suitability. In general, departures from the description required in 3.4.3.1 will require resubmission of samples. In cases of doubt, notification should be made of minor changes, which may be authorized by the Armed Services when acceptable, and no retest required. Changes wherein Service suitability is adversely affected may be cause for revocation of qualification approval retroactive to the date of change. Change of place of manufacture shall invalidate a qualification approval certificate unless specifically authorized by the Armed Services.

3.4.9 DISPOSAL OF SAMPLE TUBES

Sample tubes having a unit list price of less than ten dollars will be retained by the Laboratory making the tests or will be returned to the manufacturer at the option of the Laboratory. Other samples may be returned, at the manufacturer's expense, if return is requested not later than thirty days after the test report is mailed to the manufacturer. The Test Laboratory will exercise the utmost care in testing sample tubes, but assumes no responsibility for their condition when returned. The laboratory may cut the leads of subminiature tubes to .200 ± .015 inch when performing destructive tests. The Laboratory reserves the right, on approved tubes, to retain one sample of each approved type.

INTRODUCTION TO SECTIONS 4 AND 5
ACCEPTANCE AND REJECTION CRITERIA

These sections establish uniform criteria for defects for an individual tube. The criteria shall apply whether 100% inspection procedure or a sampling inspection procedure is used. In order to establish the AQL basis for each defect appearing in these sections, the degree of defect (major, minor or control) is indicated in a column to the right of the defect.

(See paragraph 3.1.3.) The information contained herein is for use by all Inspectors and all Tube Manufacturers. Where there is a conflict between the requirements of the individual tube type specification sheet and the criteria of these sections, the individual tube type specification sheet shall take precedence.

Tubes, which satisfy the requirements of the tube type specification sheet but which are questioned for workmanship and appearance items not covered herein with criteria, may be suitably tested by the Inspector in an effort to determine whether or not the tubes are acceptable. When a large number of such tubes is involved on which no decision can be reached, representative samples of such tubes along with a report of the test(s) already made, are to be sent to a Service Laboratory for an acceptance-rejection decision.

Changes to these sections whether by addition to, deletion, modification, or substitution of, the criteria given herein, or by inclusion of criteria for defect items so far not covered herein, should be recommended to the Armed Services Electron Tube Committee, Secretariat, Fort Monmouth, New Jersey.

In cases where a defect heading is shown, followed by an *, but no test, the criteria is still under consideration. It is expected that criteria for these headings will be available in the near future for incorporation in a subsequent edition of these instructions.

4. GENERAL VISUAL AND MECHANICAL INSPECTION

4.1 DEFINITIONS OF DEFECTS

BLISTER - A bubble in the glass due to the inclusion of air or other gas, having a maximum dimension that exceeds .025". (See also "Seed")

CHECK AND CRACKS - Fissures extending into or through the wall of the glass envelope.

CLUSTER - Two or more stones when the minimum separation is not greater than 1/16".

CORD - An attenuated transparent inclusion possessing optical or other properties differing from the parent glass.

GLASS ADHERED - A foreign piece of glass attached to the surface of a glass part.

GLASS KNOT - A small transparent area of incompletely assimilated glass having an irregular, knotty or tangled appearance; a transparent stone. The "size" of a knot refers to the maximum linear dimension of its most distinct contour. A "cluster" of knots is a group of two or more knots that are spaced not more than 1/16" apart. A cluster is considered as one knot. The size of a cluster shall be considered as the maximum over-all dimension of the group.

HARD GLASS
General term covering glasses with a low coefficient of expansion. (Usually below 50 x 10^{-7}).

SCALE
A small piece of metallic oxide or carbon embeded in the glass.

SCUFF
Small scratches or abrasions in the surface of the glass.

SEED
A small bubble in the glass due to the inclusion of air or other gas having a maximum dimension not exceeding .025", and occurring in groups. (See also "Blister").

SIDE MOLD MARKED
Side of bulb has a "pinched" appearance.

SIDE OR TOP MOLD RINGED
Surface of bulb contains circumferential undulations.

SOFT GLASS
General term covering glasses having a high coefficient of expansion (Usually above 85 x 10^{-7}).

STONE
A piece of clay or other unmelted glass batch material embedded in the glass usually evidenced as a white opaque spot. The dimension of a stone refers to the maximum linear dimension of the undigested or opaque portion. A "cluster" of stones is a group of two or more stones which are spaced not more than 1/16" apart. A cluster is considered as one stone. The dimension of a cluster shall be considered as the maximum over-all dimension of the group.

WAVY
Containing a number of fine cords.

4.1.1 SOFT GLASS ENVELOPE DEFECTS
The glass inspection criteria of this section shall apply to electron tubes made with soft glass envelopes up to and including 2-1/2" bulb design (largest) diameter. These criteria do not apply to cathode ray tubes or other optically employed devices.
NOTE: These criteria are established for glasses known to the industry as codes 001, 008, 012, 014 and 816 or equivalents.

4.1.1.1 STONES

4.1.1.1.1 SIZE
Stones up to a maximum dimension of .020"

If in quantity not over three	control
If in quantity over three	minor

4.1.1.1.2 OVER GLAZING
Stones over .020" not over-glazed. minor

4.1.1.1.3 SEPARATION

The minimum stone separation, irrespective of envelope diameters, less than 3/8". minor

4.1.1.1.4 NUMBER AND SIZE OF STONES

Number and size of stones exceeding that shown in table here given. minor

Inspection Limits for Stones Over .020"

Bulb size Glass envelope Diam.	Max. Acceptable Stone Size 1/		Max. Number of Stones Acceptable in one Bulb
	Max. if 1 Stone	Max. for each if 2 Stones	
Inch	Inch	Inch	
Up to 3/8	.025	---	1
13/32 to 5/8	.035	---	1
21/32 to 1	.050	.040	2
1-1/32 to 1-1/2	.063	.045	2
1-9/16 to 2-1/2	.085	.063	2

1/ The maximum dimension of the undigested portion (usually white in appearance and presenting a distinct contour) of a stone shall be the determining stone size.

4.1.1.2 BUBBLES

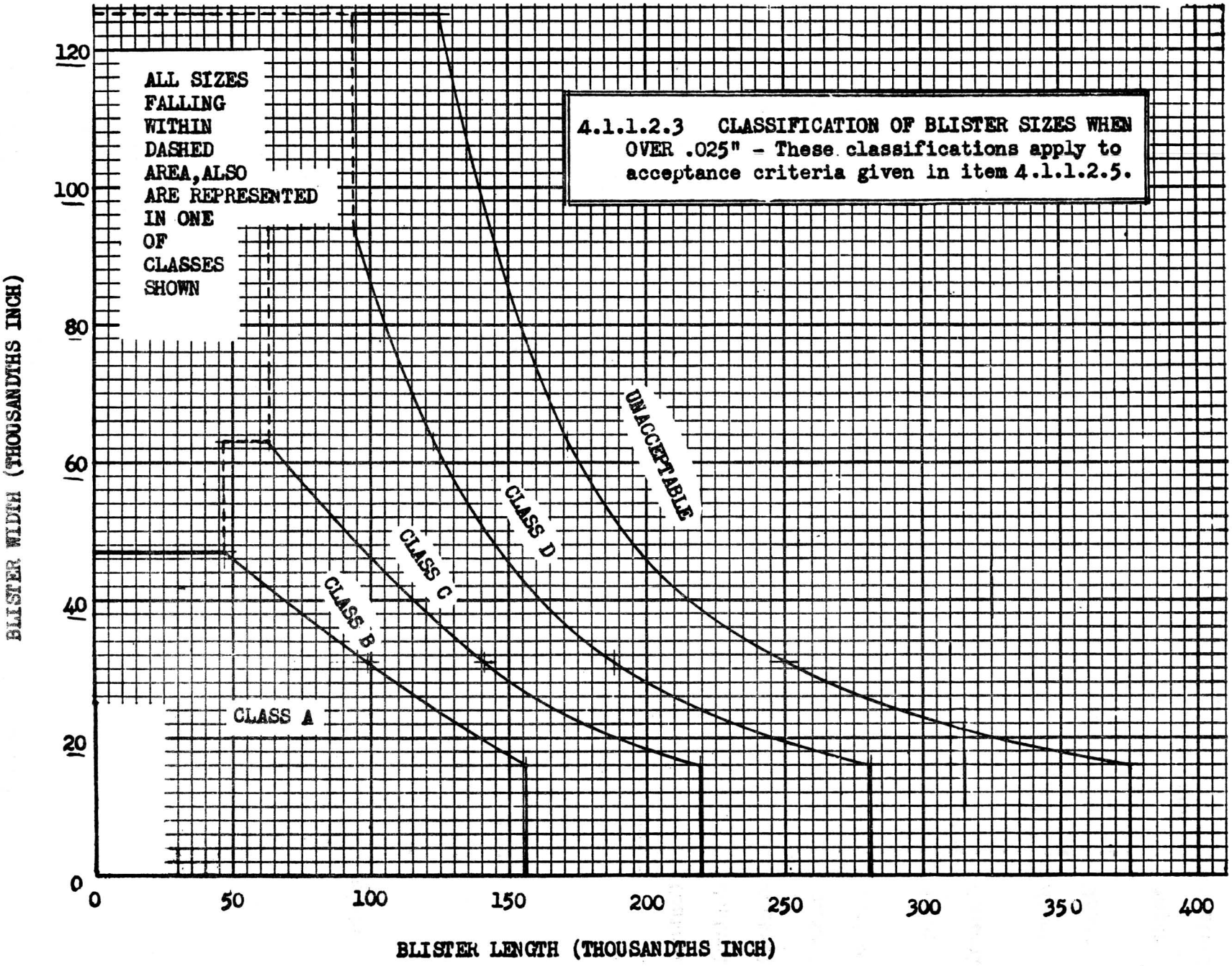
4.1.1.2.1 SEEDS

Bubbles having maximum dimension not over .025".

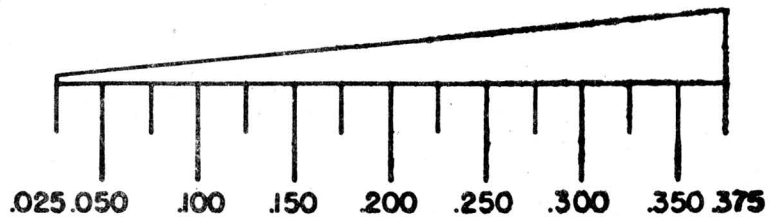
If in quantity not over three. Control
If in quantity over three. Minor

4.1.1.2.2 OPEN BLISTERS

Bulbs containing open surface blisters (unbroken blisters may be subjected only to pressure of a fingernail.) Minor


4.1.1.2.3 CLASSIFICATION OF BLISTER SIZES WHEN OVER .025" - These classifications apply to acceptance criteria given in item 4.1.1.2.5.
ALL SIZES FALLING WITHIN DASHED AREA, ALSO ARE REPRESENTED IN ONE OF CLASSES SHOWN
UNACCEPTABLE
CLASS D
CLASS C
CLASS B
CLASS A
BLISTER WIDTH (THOUSANDTHS INCH)
BLISTER LENGTH (THOUSANDTHS INCH)
0
20
40
60
80
100
120
0
50
100
150
200
250
300
350
400

4.1.1.2.4 - BLISTER MEASURING SCALE (TO BE TRANSFERRED TO FLEXIBLE TRANSPARENT SCALE FOR USE)



4.1.1.2.5 NUMBER AND CLASS OF BLISTERS OVER .025" IN ONE BULB
Total number and class of blisters exceeding that shown in the table here given: **Minor**

GLASS ENVELOPE MAX. DIAM.	PERMISSIBLE NO. OF BLISTERS OF CLASSES				
	A	B	C	D	MAX. TOTAL
0 to 3/8"	2	0	0	0	2
13/32" to 5/8"	3	0	0	0	3
21/32" to 1"	5	2	0	0	5
1-1/32" to 1-1/2"	8	4	2	0	9
1-9/16" to 2-1/2"	14	7	3	2	17

4.1.1.3 CORD **Control**

4.1.1.4 WAVY **Control**

4.1.1.5 SIDE MOLD MARKED - **Control**

4.1.1.6 SIDE MOLD RINGED - **Control**

4.1.1.7 SCUFFED BULBS - (Compare CHECKS AND CRACKS) **Control**

4.1.1.8 SCRATCHED BULB - Scratch on surface of bulb exceeding 3/4" in length: **Minor**
Bulbs of the tubes having small surface scratches not over 3/4" in length but not deep enough to be termed cracks. **Control**

4.1.1.9 GLASS ADHERED - Maximum dimension of adhered glass exceeding 3/32" **Minor**

4.1.1.10 CHECKS AND CRACKS - Any checks or cracks (other than surface cracks due to impact). When there are surface cracks due to impact and the tube does not withstand thermal shock from immersion in boiling water to immersion in ice water. **Major**
Tubes with surface cracks due to impact which withstand the above immersion. **Major**
Control

4.1.1.11	SCALE - Scale exceeding 1/32" maximum dimension.	Minor
4.1.1.12	EXPOSED SUCKED IN SEAL OFF TIPS - *	
4.1.2	HARD GLASS ENVELOPE DEFECTS - *	
4.1.2.1	STONES	
4.1.2.1.1	SIZE - *	
4.1.2.1.2	OVERGLAZING - *	
4.1.2.1.3	SEPARATION - *	
4.1.2.1.4	INSPECTION LIMITS FOR STONES OVER 1/32". - *	
4.1.2.2	BUBBLES	
4.1.2.2.1	OPEN BLISTERS - *	
4.1.2.2.2	UNBROKEN BLISTERS-*	
4.1.2.3	CORD-*	
4.1.2.4	WAVY-*	
4.1.2.5	SIDE MOLD MARKED-*	
4.1.2.6	SIDE MOLD RINGED-*	
4.1.2.7	SCUFFED BULB-*	
4.1.2.8	SCRATCHED BULB-*	
4.1.2.9	GLASS ADHERED-*	
4.1.2.10	CHECKS AND CRACKS-*	
4.1.2.11	SCALE-*	
4.1.2.12	GLASS KNOT-*	
4.1.2.13	EXPOSED SUCKED IN SEAL-OFF-TIPS-*	
4.1.2.14	BULB DISCOLORATION-*	
4.1.3	VACUUM SEALS - METAL TO GLASS -*	
4.1.3.1	COPPER TO GLASS FEATHER EDGE SEALS -*	
4.1.3.1.1	COLOR -*	
4.1.3.1.2	SHALE -*	
4.1.3.1.3	CRACKS -*	
4.1.3.1.4	BUBBLES -*	
4.1.3.1.5	COMBINATION OF SHALES, BUBBLES, CRAKCS AND REJECTABLE COLOR-*	
4.1.3.1.6	WRINKLED FEATHER EDGE -*	
4.1.3.1.7	SPLITS IN FEATHER EDGE-*	
4.1.3.2	FERNICO, KOVAR, OR RODAR TO GLASS SEALS - *	
4.1.3.2.1	CYLINDRICAL EDGE TYPE SEALS - *	
4.1.3.2.1.1	COLOR - *	
4.1.3.2.1.2	BUBBLES - *	
4.1.3.2.1.3	SHALE -*	
4.1.3.2.1.4	CRACKS -*	
4.1.3.2.1.5	SPLITS IN METAL EDGE -*	
4.1.3.2.2	DISC AND WINDOW TYPE SEALS	
4.1.3.2.2.1	SHALE -*	
4.1.3.2.2.2	CRACKS - *	
4.1.3.2.2.3	BUBBLES -*	
4.1.3.2.2.4	COLOR - *	
4.1.3.2.3	EYELET TO GLASS TO LEAD SEAL	
4.1.3.2.3.1	CRACKS -*	
4.1.3.3	TUNGSTEN ROD TO GLASS SEALS -*	
4.1.3.3.1	ENVELOPE SEALS WITH EXTERNAL BOSSES - *	
4.1.3.3.1.1	CHECKS - *	
4.1.4	METAL ENVELOPES	
4.1.4.1	DENTS	
4.1.4.1.1	NUMBER - If there are more than two dents in a tube:	Minor
4.1.4.1.2	DEPTH - Any dent exceeding 1/32" in depth:	Minor

4.1.4.2	**PAINT**	
4.1.4.2.1	CRIMPING - The base wafer crimping process causes exposed body metal to a distance greater than 3/32" above top edge of base wafer.	Minor
4.1.4.2.2	MARS, PEELING BLEMISHES - Combined total area of exposed metal exceeding 1/4" x 1/8" or equivalent area:	Minor
4.1.4.2.3	SCRATCHES - A scratch on the painted surface exposing body metal in excess of 1/2" in length:	Minor
4.1.4.3	BRAZING -*	
4.1.5	BASES	
4.1.5.1	THERMOSETTING PLASTIC BASES	
4.1.5.1.1	BLISTERS ON SIDE OF BASE	
4.1.5.1.1.1	UNBROKEN BLISTERS - Base not passing maximum O.D. (Unbroken surface blisters may be subjected only to pressure of a finger nail.)	Major
4.1.5.1.1.2	BROKEN BLISTERS	
4.1.5.1.1.2.1	SIZE - Any single broken blister larger than 1/8" x 1/8" or equivalent area.	Minor
4.1.5.1.1.2.2	NUMBER - More than five broken blisters larger than .030" maximum dimension.	Minor
4.1.5.1.2	BLISTERS ON BOTTOM OF BASE	
4.1.5.1.2.1	POSITION- Blister(s) connecting any two base pins.	Major
4.1.5.1.2.2	HEIGHT - Blister exceeding .010" in height.	Major
4.1.5.1.2.3	OPEN - Broken blisters over .030" maximum dimension: (Unbroken surface blisters may be subjected only to pressure of a finger nail)	Minor
4.1.5.1.3	BLISTERS ON GUIDE LUG - Lug not passing maximum O.D.	Major
4.1.5.1.4	CHIPS	
4.1.5.1.4.1	SIZE - Chips smaller than .030" maximum dimension are not to be cause for rejection. (except on guide lug keys).	
4.1.5.1.4.2	DEPTH - Individual chips deeper than 1/32"	Minor
4.1.5.1.4.3	AREA - Chips are larger than 1/8" or equivalent area.	Minor
4.1.5.1.4.4	CORNER CHIPS - Corner chips extending more than 1/8" along any of the intersecting surfaces:	Minor
4.1.5.1.4.5	KEY CHIPS - Chipped guide lug key:	Minor

4.1.5.1.4.6	NUMBER - More than five open blisters. More than five chipped places	Minor
4.1.5.1.5	CRACKS	
4.1.5.1.5.1	NUMBER - Any cracks	Major
4.1.5.1.6	SCRATCHES -*	
4.1.5.2	CERAMIC BASES	
4.1.5.2.1	CHIPS	
4.1.5.2.1.1	DEPTH -*	
4.1.5.2.1.2	AREA -*	
4.1.5.2.1.3	CORNER CHIPS -*	
4.1.5.2.1.4	KEY CHIPS -*	
4.1.5.2.1.5	NUMBER -*	
4.1.5.2.2	CRACKS	
4.1.5.2.2.1	DEEP CRACKS - Any body cracks:	Major
4.1.5.2.2.2	GLAZE CRACKS - Any glaze cracks extending from one pin to another.	Minor
	Any other glaze cracks	Control
4.1.5.2.2.3	SCRATCHES - Base scratched:	Control
4.1.5.3	METAL BASES	
4.1.5.3.1	DENTS	
4.1.5.3.1.1	NUMBER -*	
4.1.5.3.1.2	DEPTH -*	
4.1.5.3.2	PLATING - A scratch exposing base metal exceeding 1/2" in length:	Minor
	Scratches not exposing base metal	Control
4.1.5.3.2.2	PEELING AND BLISTERS - Any peeling of plating where plating is required for electrical reasons:	Major
	Peeling of plating where appearance is seriously affected:	Minor
	Peeling of plating or blisters where appearance only is involved, providing the appearance of the tube is not seriously affected:	Control
4.1.5.3.2.3	DISCOLORATION -*	
4.1.5.4	BASE PINS	
4.1.5.4.1	BAYONET PINS	

4.1.5.4.1.1 LATERAL MOTION - Total Lateral motion exceeding 1/64": Minor

4.1.5.4.1.2 ROTATION - The staked bayonet pin rotates, but cannot be pushed into base wall: Control
Unstaked pin rotates: Minor

4.1.5.4.2 CONTACT PINS

4.1.5.4.2.1 LATERAL MOTION - Total lateral motion of contact pins, other than pins sealed directly into the glass, exceeding 1/32" at pin tip when moved with the fingers. Minor
Pins sealed directly in glass shall have no motion.

4.1.5.4.2.2 ROTATION - Any contact pin rotation:

4.1.5.4.2.3 ALINEMENT-*

4.1.5.4.2.4 INCREASED DIAMETER BY SOLDER - Maximum diameter by presence of solder is greater than that shown below: Minor

Bogey pin diameter from base drawing	Max. diameter
.093"	.098"
.125"	.131"
.156"	.162"
.187"	.195"
.312"	.320"

4.1.5.5 BASE INSERTS - *

4.1.5.5.1 CERAMIC WAFER - *

4.1.5.5.2 GLASS - *

4.1.6 SOFT SOLDER DEFECTS

4.1.6.1 LOOSE UNSOLDERED WIRES - Loose or unsoldered wire or wires in pins or caps Major

4.1.6.2 EXPOSED WIRE - More than 1/32" of wire length exposed beyond end of pin or cap; or 1/32" of wire length exposed beyond solder when end of pin or cap concealed by solder. Minor

4.1.6.3 EXCESS PIN SOLDER - See "Increased Diameter by Solder (See 4.1.5.4.2.4)

4.1.6.4 SOLDERING OF WIRE TO BASE PINS - *

4.1.7 INTERNAL MECHANICAL STRUCTURE DEFECTS

4.1.7.1 IRREGULARITY OF INTERNAL STRUCTURE - Tubes which satisfy the requirements of the tube type specification sheet but which are questioned because of irregularity of the internal structure, may be suitably tested by the inspector in an effort to determine whether or not the tubes are acceptable. When a considerable quantity of such tubes is involved on which no decision can be reached, representative samples of such tubes along with a report of the test(s) already made, are to be sent to a Service Laboratory for an acceptance-rejec-

tion decision.

4.1.7.2 RATTLES - See Loose Particles (See 4.1.7.3)

4.1.7.3 LOOSE PARTICLES IN RECEIVING AND ALLIED TYPES (IN ANY PART OF FINISHED TUBE)

4.1.7.3.1 LOOSE PARTICLES THAT BY VISUAL INSPECTION CAN BE DETERMINED TO BE OF A NON-CONDUCTING NATURE

4.1.7.3.1.1 MICA - Any single particle exceeding 3/8" longest dimension Minor
More than five (5) of the mica particles exceeding 1/32" longest dimension: Minor

4.1.7.3.1.2 OTHER NON-CONDUCTING MATERIAL - Any single particle exceeding 1/8" longest dimension. Minor
More than three (3) of the particles exceeding 1/64" longest dimension. Minor

4.1.7.3.2 LOOSE PARTICLES THAT BY VISUAL INSPECTION CAN BE DETERMINED TO BE OF A CONDUCTING NATURE

4.1.7.3.2.1 LOOSE PARTICLES (Other than Getter flash) Major

4.1.7.3.2.2 GETTER FLASH - Getter flash parted from the glass over an area in excess of 1/16" maximum dimension: Major

4.1.7.3.3 LOOSE PARTICLES THAT CANNOT BE SEEN OR THAT, BY VISUAL MEANS ALONE, CANNOT BE DETERMINED TO BE OF A CONDUCTING OR NON-CONDUCTING NATURE - The criterion is the test identified as a "free-socket" short-circuit test. This test consists of a conventional short-circuit test equipment, with a socket on the end of a flexible cable connected so as to give indication of any momentary, temporary, or permanent short-circuit between any of the electrodes of the tube as it is shaken, upset, twisted, turned, vibrated, etc., by holding the "free-socket" in the hand. Any momentary, temporary or permanent evidence of a short circuit is shown: Major

4.1.7.4 INTERNAL WELDS -*

4.1.8 ASSEMBLY DEFECTS

4.1.8.1 ENVELOPE AND BASE

4.1.8.1.1 ENVELOPE AND BASE ALINEMENT - Maximum distance to the outermost point of the bulb exceeding 60% of the specified maximum bulb diameter, using the center line of the base as a reference: Minor

4.1.8.1.2 CEMENTING

4.1.8.1.2.1 LOOSENESS - Any immediately apparent looseness of cemented junction of base: Major

4.1.8.1.2.2 EXCESS CEMENT - Cement protruding more than 1/16" on bases under 1-1/2" in diameter: Minor
Cement protruding more than 3/16" on bases 1-1/2" in diameter or over: Minor

4.1.8.1.2.3 VOIDS -*

4.1.8.2 WAFERS AND BASE OR ENVELOPE

4.1.8.2.1 ROTATIONAL MOVEMENT - Total rotational movement of wafer with respect to crimped metal exceeds 1/32" when tried with the fingers: Minor

4.1.8.2.2 SEPARATING MOVEMENT - Any movement separating any part of the wafer away from the crimped metal exceeding 1/64" when tried with the fingers: Minor

4.1.8.2.3 BASE WAFER CRIMPING REMOVES PAINT -*

4.1.8.3 TOP CAP AND ENVELOPE

4.1.8.3.1 ALINEMENT - Center line of top cap departing from center line of bulb by more than 10% of diameter of dome: Minor

4.1.8.3.2 CEMENTING

4.1.8.3.2.1 EXCESS - Excess cement protruding from edge of cap more than 1/32" from edge of cap with contact diameter of 3/8" or less, or more than 1/16" from edge of cap with contact diameter over 3/8": Minor

4.1.8.3.2.2 LOOSENESS - Any looseness of cemented junction of top cap: Major

4.1.8.3.3 CRIMPING - Total rotational movement from top cap to envelope of metal tubes exceeding 22-1/2 degrees when tried with the fingers: Minor

4.1.8.3.4 DENTS - *
4.1.8.3.4.1 DEPTH - *
4.1.8.3.4.2 NUMBER - *
4.1.8.3.5 WELDS - *
4.1.9 STRANDED LEAD CABLES *
4.1.9.1 FRAYED LEADS - *
4.1.10 AIR COOLED FIN TYPE RADIATOR - *
4.1.10.1 SOLDER OBSTRUCTION - *
4.2 ELECTRICAL INSPECTION - *

4.3 LIFE TEST

4.3.1 CALCULATION OF AVERAGE LIFE. - In calculating the average life of a life test group of tubes, the life of each tube shall be determined by adding to the hours at the last life-test-end-point passing test either 10 percent of the hours specified as the minimum life or one-half of the hours between the last life-test-end-point passing test and the life-test-end-point failure test, whichever value is smaller. At the conclusion of the time specified for life test, the

average life of the life test group of tubes placed on test shall not be less than 80 percent of the number of hours specified unless otherwise indicated on the Tube Specification Sheet. If this percentage is not attained, all tubes represented by the samples shall be rejected subject to negotiation. Any tube which becomes inoperative or which fails to meet the life test end point requirements at any reading period beyond zero hours shall be considered a defective tube in life test.

4.3.2 RELEASE PRIOR TO COMPLETION OF LIFE TEST. - The Service inspector may release lots of tubes for shipment prior to completion of life tests when the completed average life of the life test group of tubes placed on test is greater than the value indicated, provided the immediate preceding life tests on that tube meet the requirements and at the time of release the life test on the specific lot has not already failed.

Minimum Completed Average Life of Tubes Placed on Test	Qualifications
80% of possible life of group (unless otherwise indicated on the Tube Specification Sheet).	If more than one life test group failed in the last 10 life test groups unless covered below.
60% of possible life of group	If no life test group failed in last 3 life test groups, or not more than one life test group failed in last 10 life test groups.
30% of possible life of group	If no life test group failed in last 5 life test groups, or not more than one life test group failed in last 14 life test groups.
10% of possible life of group	If no life test group failed in last 7 life test groups or not more than one life test group failed in last 17 test groups.
0% of possible life of group	If no life test group failed in last 10 life test groups

4.3.3 FAILURE AFTER SHIPMENT. - In the event a life test group fails and the lot of tubes represented by the group has been shipped prior to completion of the life test, the price of that lot of tubes shall be subject to renegotiation.

5 PROCEDURE AND CRITERIA PECULIAR TO SPECIFIC FAMILIES AND TYPES OF TUBES.

5.1 RECEIVING TYPE ELECTRON TUBES.*

5.2 CRITERIA FOR ACCEPTANCE AND REJECTION OF RECEIVING TYPE ELECTRON TUBES - SHOCK TEST.

5.2.1 AUTHORIZATION - Lots of tubes of any one type may be tested according to the normal, reduced, and special inspection procedures outlined in paragraphs 5.2.4.1, 5.2.4.2 and 5.2.4.3 of this Section when shock test is specified.

5.2.2 DEFINITIONS - Certain terms, for the purpose of this Section, require more specific definition than that appearing in Section 2. Such terms are defined below.

5.2.2.1 LOT - A lot shall be as defined in MIL-STD-105A, and shall consist of tubes of one type manufactured during the period not longer than one week. No lot shall be larger than five (5) times the average size of the preceding five (5) lots.

5.2.2.2 ACCEPTABLE QUALITY LEVEL - (AQL) An acceptable quality level of twenty percent (20%) defective tubes (combined mechanical and electrical) is the basis for the sampling specified in this section.

5.2.2.3 DEFECTIVE - A tube which was satisfactory originally but does not meet the post-shock requirements of the applicable tube specification sheets after having been shock tested shall be considered defective.

5.2.3 MEANS OF ASSURING AQL - The procedure provided for the maintenance of the AQL consists of a variation in sample size determined by the process average.

5.2.4 SELECTION OF SAMPLING SCHEME - Either normal, reduced or special sampling shall be used in accordance with the provisions of paragraphs 5.2.4.1, 5.2.4.2 or 5.2.4.3.

5.2.4.1 NORMAL SAMPLING - Normal sampling shall be used when:

a. Process Average Not Established. - The process average has not been established in accordance with paragraph 5.2.5.1 of this Section.

b. Process Average more than AQL. - The process average as determined by the provisions of paragraph 5.2.5.1 of this section is more than 20 percent defective.

The sampling plan shall be that specified in table 5.2-1

5.2.4.1.1 ACCEPTANCE OF LOTS - Lots shall be accepted if the number of defectives found in a sample of the size (n) specified in Table 5.2-1 is equal to or less than the acceptance number (c) found in that table.

5.2.4.1.2 REJECTION OF LOTS - Lots shall be rejected if the number of defectives found in a sample of the size (n) specified in Table 5.2-1 is equal to or greater than the rejection number (r) found in that table.

NORMAL SAMPLING PLAN

Table 5.2-1

Sample Size n	Acceptance Number c	Rejection Number r
48	14	15

5.2.4.2 REDUCED SAMPLING - Reduced sampling shall be used when the process average as determined in paragraph 5.2.5.1 of this section shows less than 20 percent defective. The sampling plan to be used shall be determined by use of table 5.2-2 in conjunction with the process average

5.2.4.2.1 ACCEPTANCE OF LOTS - Lots shall be accepted by initial sample or initial and second samples combined as specified below:

a. Initial Sample - Lots shall be accepted if the initial sample of size (n1) as specified in Table 5.2-2 contains a number of defectives equal to or less than acceptance number (c1) specified in that table.

b. Second Sample - If the initial sample has more than the number of defectives specified in Table 5.2-2 as acceptable (c1) but less than the number specified as rejectable (r1), a second sample of size (n2) shall be tested. If the total number of defectives found in both the initial and second samples is equal to or less than the combined acceptance number (cc), the lot shall be accepted.

5.2.4.2.2 REJECTION OF LOTS - Lots shall be rejected by initial sample or initial and second samples combined as specified below:

a. Initial Sample - Lots shall be rejected if the initial sample of size (n1) as specified in Table 5.2-2 contains a number of defectives equal to or greater than the rejection number (r1) specified in Table 5.2-2.

b. Second Sample - Lots shall be rejected if the total number of defectives found in the initial and second samples is equal to or greater than the combined rejection number (r_c) specified in Table 5.2-2.

REDUCED SAMPLING PLAN
Table 5.2-2

Process Average	Initial Sample Size	Initial Acceptance No.	Initial Rejection No.	Second Sample Size	Combined Sample Size	Combined Acceptance No.	Combined Rejection No.
p	n_1	c_1	r_1	n_2	n_c	c_c	r_c
0-5.00%	4	0	---	16	20	7	8
5.01-15.00%	12	1	8	20	32	11	12
15.01-20.00%	20	2	11	20	40	13	14

5.2.4.3 SPECIAL SAMPLING - Special sampling may be used under the following circumstances:

a. Small Lots. - When lots consist of less than 1,000 tubes, special sampling may be employed.

b. Mixed Lots. - When lots cannot be considered to be homogeneous due to the inability to meet the requirement of paragraph 5.2.2.1 of this Section, special sampling shall be used.

5.2.4.3.1 SMALL LOTS - The special sampling procedure for small lots may be used for samll lots in place of the normal or reduced sampling procedures specified in paragrpahs 5.2.6.1 and 5.2.6.2 of this Section. The sampling inspection of small lots may be performed in accordance with the provisions of Table 5.2-3 of this Section.

5.2.4.3.2 ACCEPTANCE OF LOTS - Small lots shall be accepted by initial sample or initial and second samples combined as specified below:

a. Initial Sample - Lots shall be accepted if the initial sample of size (n_1) as specified in Table 5.2-3 contains a number of defectives equal to or less than acceptance number (c_1) specified in Table 5.2-3

b. Second Sample - If the initial sample has more than the number of defectives specified in Table 5.2-3 as acceptable (c_1) but less than the number specified as rejectable (r_1), a second sample of size (n2) shall be tested. If the total number of defectives found in both the initial and second samples is equal to or less than the combined acceptance number (c_c), the lot shall be accepted.

5.2.4.3.3 REJECTION OF LOTS - Small lots shall be rejected by initial sample or initial and second samples combined as specified below:

a. Initial Sample - Lots shall be rejected if the initial sample of size (n_1) as specified in Table 5.2-3 contains a number of defectives equal to or greater than the rejection number (r_1) specified in Table 5.2-3.

b. Second Sample - Lots shall be rejected if the total number of defectives found in the initial and second samples is equal to or greater than the combined rejection number (r_c) specified in Table 5.2-3

5.2.4.3.4 MIXED LOTS - The sampling inspection of mixed lots shall be in accordance with Table 5.2-3 and paragraphs 5.2.4.3.2 and 5.2.4.3.3 of this Section

SPECIAL SAMPLING PLAN

Table 5.2-3

Lot Size	Initial Sample Size n_1	Initial Acceptance No. c_1	Initial Rejection No. r_1	Second Sample Size n_2	Combined Sample Size n_c	Combined Acceptance No. c_c	Combined Rejection No. r_c
1-399	4	0	---	8	12	4	5
400-599	8	1	7	12	20	7	8
600-799	12	1	8	20	32	11	12
800-999	20	2	11	20	40	13	14

5.2.5 PROCESS AVERAGE

5.2.5.1 ESTABLISHMENT OF PROCESS AVERAGE - A total of 192 tubes taken from a minimum of four (4) lots shall be used to compute the process average. In this computation, not more than 48 tubes shall be considered from any one lot. The process average shall be recomputed after each lot has been inspected in order to determine the applicability of reduced or normal sampling to the succeeding lot. Only initial sample results shall be used in computing the process average. The process average shall be recomputed through the use of the initial sampling results of the requisite number of preceding lots to have a total sample of at least 192 tubes.

5.2.5.2 RE-ESTABLISHMENT OF PROCESS AVERAGE - Upon the rejection of a lot while using normal or reduced sampling, it shall be necessary to re-establish the process average before proceeding to the use of reduced sampling. The reestablishment shall be accomplished by inspecting the next four lots in accordance with Table 5.2-1 of this Section. The new process average shall be based upon the data obtained on 192 tubes, samples obtained by selecting 48 tubes from each of 4 lots.

5.2.5.3 LACK OF KNOWLEDGE OF PROCESS AVERAGE - When insufficient data are available for the establishment of the process average as specified in paragraph 5.2.5.1, normal or special sampling shall be used as specified in paragraphs 5.2.4.1 and 5.2.4.3.

5.3 RECEIVING TYPE ELECTRON TUBES - RELIABLE

5.3.1 APPLICABILITY, DEFINITIONS AND SYMBOLS

5.3.1.1 APPLICABILITY - The sampling procedures outlined in this section are intended for use in the acceptance sampling inspection of those receiving type tubes designated as "Reliable Tubes".

5.3.1.1.1 AUTHORIZATION - Lots of tubes may be sampled in accordance with the provisions of this section when its use is authorized in the governing specification.

5.3.1.2 SCOPE - This section provides various acceptance sampling procedures for use with reliable tubes and contains:

(1) Introductory terminology.

(2) An acceptance sampling procedure by attributes to check the percentage of defective tubes in a lot.

(3) An acceptance sampling procedure by variables to check the distribution of tube characteristics within a lot.

(4) A life test sampling procedure to evaluate the failure rate of a lot.

(5) A sampling procedure for Miniature Tube Base Strain Tests.

(6) A sampling procedure for Short and Continuity Tests.

(7) A sampling procedure for Heater Cycling Tests.

(8) Criteria for acceptance and rejection - visual and mechanical inspection of reliable subminiature tubes.

5.3.1.3 DEFINITIONS - In addition to the definitions listed in section 2 of these instructions and in Specification MIL-E-1B, the following shall be taken as the definitions of the terms listed below in the use of this section.

ACCEPTANCE LIMITS FOR AVERAGES OF SAMPLES - The Acceptance Limits for Averages of Samples are those limits which determine the acceptability of the lot whith respect to lot averate. The limits shall be computed so that the probability of acceptance is 95% for a lot whose average is equal to the USLA or LSLA. The Acceptance Limits for Averages of Samples are designated as follows:

(1) Upper Acceptance Limit for Averages of Samples = UAL

(2) Lower Acceptance Limit for Averages of Samples = LAL

ACCEPTANCE LIMIT FOR SAMPLE DISPERSION (ALD) - The acceptance Limit for Sample Dispersion is that limit which determines the acceptability of a lot with respect to lot dispersion. The limit shall be computed so that the probability of acceptance is 95% for a lot whose standard deviation is the MRSD.

ALLOWABLE SHIFT - For any life test characteristic, the allowable shift is the permissible average percentage change of Life Test Sample "B" at the designated reading period from the readings of Life Test Sample "B" at zero hours. The average percentage change shall be ascertained from the determination of the individual change(s) for each tube in the life test sample from the zero hour value(s) for the referenced characteristic(s). For the purposes of computation of this average percentage change the absolute value of the individual changes for each tube in the life test sample shall be used. Any tube found to be inoperative during life testing shall not be considered in the calculation of this average. Allowable shifts shall not be designated for these characteristics having asymmetrical distribution, such as leakage, gas, or grid emission.

FACTOR "a" - Factor "a" is a function of sample size, and is used in computation of the Acceptance Limit for Sample Dispersion in accordancewith Par. 5.3.3.8.3.1 of this manual. (See 5.3.3.10.4)

FACTOR "k" - Factor "k" is a function of sample size, and is used in the computation of Acceptance Limits for Sample Averages in accordance with Par. 5.3.3.8.3.2 of this manual. (See 5.3.3.10.5)

LIFE TEST SAMPLE "A" - Life Test Sample "A" is that group of tubes which is to be operated for 100 hours.

LIFE TEST SAMPLE "B" - Life Test Sample "B" is that group of twenty (20) tubes which is to be operated for 500 hours.

LIFE TEST SAMPLE "C" - Life Test Sample "C" is that group of ten (10) tubes which is to be operated for 1000 hours.

LOT - A lot shall be as defined in MIL-STD-105A, and shall consist of tubes of one type manufactured during the period not longer than one week or 301 tubes, whichever is greater. No lot shall be larger than five times the average size of the preceding five lots. Exceptions to the above shall be as indicated in the specific tests in following paragraphs.

MAXIMUM RATED STANDARD DEVIATION (MRSD) - The Maximum Rated Standard Deviation shall be as designated on the tube specification sheet.

RELIABLE TUBES - Reliable tubes are those tubes so designed and manufactured as to give continuity of operation superior to ordinary commercial tubes. Reliable tubes shall be so designated on their tube specification sheets.

SPECIFICATION LIMITS FOR AVERAGES OF ACCEPTABLE LOTS - The Specification Limits for Averages of Acceptable Lots shall be designated on the tube specification sheet as follows, and shall be expressed in absolute values:

(1) Upper Specification Limit for Averages of Acceptable Lots = USLA
(2) Lower Specification Limit for Averages of Acceptable Lots = LSLA

STANDARD DEVIATION - The standard deviation of a set of numbers is a measure of their dispersion, and is equal to the root-mean-square (RMS) deviation of the numbers from their average.

VARIABLES INSPECTION LEVEL (VIL) - The Variables Inspection Level is an index of the ability of a variables sampling plan to differentiate between good and bad lots. This ability to differentiate increases as the Variables Inspection Level increases. (See 5.3.3.10.2)

5.3.1.4 ABBREVIATIONS AND SYMBOLS - For the purpose of simplification, the following abbreviations and symbols are used in this section.

"a" - A factor used in the computation of the acceptance limit for dispersion.

AQL - Acceptable Quality Level (See General Definitions)

Ac - Acceptance number - the number of defects allowable in an acceptable sample.

"k" - A factor used in the computation of acceptance limits for sample averages.

LAL - Lower Acceptance Limit for Averages of Samples.

LSLA - Lower Specification Limit for Averages of Acceptable Lots.

MRSD - Maximum Rated Standard Deviation.

N - Number of tubes in a lot.

n - Number of tubes in a sample.

ALD - Acceptance Limit for Sample Dispersion.

UAL - Upper Acceptance Limit for Averages of Samples.

USLA - Upper Specification Limit for Averages of Acceptable Lots.

VIL - Variables Inspection Level

5.3.2 ACCEPTANCE SAMPLING PROCEDURE BY ATTRIBUTES

5.3.2.1 APPLICABILITY - This attributes acceptance sampling procedure shall be used when an Inspection Level and an AQL are designated as acceptance inspection conditions on the applicable tube specification sheets.

5.3.2.2 SAMPLING TABLES - The inspection procedures and sampling plans used for attributes inspection shall be those given in MIL-STD-105A, and Table 5.3-1 of these Instructions.

5.3.2.3 SPECIFICATION OF ATTRIBUTES PLAN - The Inspection Level and the AQL, expressed in percent defective, shall be given as acceptance inspection conditions on the tube specification sheets for individual tests and/or may be given for groups of tests. Lot acceptance shall be based upon conformance to all designated AQL values.

5.3.2.4 NORMAL, TIGHTENED AND REDUCED INSPECTION- The use of normal, tightened or reduced inspection shall be determined by the provisions of MIL-STD-105A. In addition to the provisions of MIL-STD-105A (paragraph 9), tightened inspection shall be used if two consecutive lots are non-conforming.

5.3.2.5 ADDITIONAL INSPECTION LEVELS - Table 5.3-1 of this section provides three additional inspection levels for use in conjunction with MIL-STD-105A. These inspection levels are provided for those cases in which a large sampling risk can be tolerated.

Table 5.3-1

ADDITIONAL INSPECTION LEVELS FOR USE WITH MIL-STD-105A

SAMPLE SIZE CODE LETTERS

LOT SIZE	INSPECTION LEVELS		
	1C	1B	1A
301-800	E	E	E
801-1300	E	E	F
1301-3200	E	F	G
3201-8000	E	G	H
8001 and over	E	G	I

Note: Letters are sample size code letters as given in Tables IVA and V of MIL-STD-105A
Single Sampling only shall be used with the above table.

5.3.3 ACCEPTANCE SAMPLING PROCEDURE BY VARIABLES

5.3.3.1 APPLICABILITY - This variables acceptance sampling procedure shall be used when designated on the applicable tube specification sheet.

5.3.3.2 MEANS OF ASSURING QUALITY - The sampling procedure provided to assure conformance of process average and dispersion includes normal sampling and reduced sampling. Instructions are given in subsequent paragraphs which explain the conditions which allow or require a change from one sampling procedure to another depending upon the Service approved acceptance record. Records shall be maintained of sampling results on each tube type.

5.3.3.3 VARIABLES INSPECTION LEVEL - The variables inspection level shall be designated as an acceptance inspection condition on the individual tube specification sheets.

5.3.3.4 SAMPLE SELECTION - Each sample is to be obtained so as to represent fairly the quality of the entire lot. The method of assuring this may vary from plant to plant, however, the practice will consist essentially of obtaining the sample at random from several cartons in the lot, and from varying positions in the cartons. Consistent patterns of selection shall be avoided.

5.3.3.5 NORMAL INSPECTION - The variables sampling procedure described in paragraph 5.3.3.8 of this section shall be used for normal inspection. Sample sizes and the factors necessary to compute acceptance limits are listed in Table 5.3-2.

5.3.3.6 REDUCED INSPECTION - The variables sampling procedure described in paragraph 5.3.3.8 of this section shall be used for reduced inspection. Sample sizes and the factors necessary to compute acceptance limits are listed in Table 5.3-2.

5.3.3.6.1 QUALIFICATION - Reduced inspection may be used if the following conditions are met:

(1) Each lot in the last 20 submitted under either normal inspection or reduced inspection shall have been acceptable.

(2) The characteristic average (process center) and the standard deviation, as calculated from samples selected from the last 20 lots, shall fall between the USLA and LSLA and below the MRSD respectively.

5.3.3.6.2 DISQUALIFICATION - Normal inspection shall replace reduced inspection whenever the eligibility requirements for reduced inspection are not met.

5.3.3.7 NON-CONFORMING LOTS - Before resubmission to the acceptance sampling test by variables, a non-conforming lot shall be reworked and/or retested 100% by the manufacturer. If the non-conforming test item is of such nature that 100% retesting without rework is sufficient, the lot may be resubmitted to test by variables for the non-conforming test item only. If the non-conforming test item is of such nature as to require rework and retest, all the lot shall be re-inspected for all characteristics which are specified for variables testing.

NOTE: If the product is considerably off-center, it may be necessary to test to limits tighter than the specified min. or max. in order to move the average (or median) within limits for acceptance.

5.3.3.8 OPERATION OF THE VARIABLES SAMPLING PLAN (FOR VARIABLES CHARACTERISTICS FOR WHICH MRSD IS SPECIFIED.)

5.3.3.8.1 TEST FOR LOT DISPERSION - Select and test a sample of size "n" as specified in Table 5.3-2. Divide the sample into random sub-groups of 5 tubes each and determine the range (R) for each sub-group. Compute the average range ($\overline{R}$). If the sample $\overline{R}$ is equal to or less than the ALD accept the characteristic for dispersion. If $\overline{R}$ is greater than the ALD, the lot shall be declared non-conforming with respect to dispersion. An alternate routine method for determining standard deviation may be used upon agreement between the manufacturer and the Services. The values of standard deviation obtained by any alternate routine method shall be multiplied by 2.33 and the resulting value compared with the ALD.

5.3.3.8.2 TEST FOR LOT AVERAGE - Using the same sample as in Par. 5.3.3.8.1 compute the average value or median value of the characteristic. If the value of the designated parameter is within or on the Acceptance Limits for Sample Averages accept the characteristic for lot average. If the value is outside the Acceptance Limits for Sample Averages, the lot shall be declared non-conforming with respect to lot average.

5.3.3.8.3 COMPUTATION OF LIMITS - The ALD, UAL and LAL shall be determined in the following manners.

5.3.3.8.3.1 ACCEPTANCE LIMIT FOR SAMPLE DISPERSION - The Acceptance Limit for Sample Dispersion shall be determined by multiplying the Maximum Rated Standard Deviation by factor "a", which is listed in Table 5.3-2.

Thus: ALD = "a" (MRSD)

5.3.3.8.3.2 ACCEPTANCE LIMITS FOR AVERAGES OF SAMPLES - The Acceptance Limits for Averages of Samples shall be determined by adding the product of the Maximum Rated Standard Deviation and the factor "k", which is listed in Table 5.3-2, to the USLA and substracting the product form the LSLA, thus:

(1) Upper Acceptance Limit for Averages (UAL)
UAL = USLA + k (MRSD)

(2) Lower Acceptance Limit for Averages (LAL)
LAL = LSLA - k (MRSD)

5.3.3.8.4 COMPUTATION OF DISPERSION - The various measures of dispersion shall be determined in the following manners.

5.3.3.8.4.1 DETERMINATION OF RANGE - The range of a sub-group is the difference between the maximum and the minimum values of the sub-group.

Thus R= maximum- minimum

5.3.3.8.4.2 DETERMINATION OF $\overline{R}$ - The average value of the range for the sample is the sum of the ranges of the sub-groups divided by the number of sub-groups (m).

Thus: $\overline{R} = \frac{R_1 + R_2 + R_3 + \ldots + Rm}{m}$

5.3.3.8.4.3 DETERMINATION of $\bar{\bar{R}}$ - The average of the range for a series of 10 samples is the sum of the average ranges ($\bar{R}$) of the 10 samples divided by 10.

$$\text{Thus: } \bar{\bar{R}} = \frac{\bar{R}_1 + \bar{R}_2 + \bar{R}_3 + \cdots + \bar{R}_{10}}{10}$$

5.3.3.8.4.4 DETERMINATION OF STANDARD DEVIATION - The standard deviation is the average of the ranges ($\bar{R}$) of each of the 10 samples divided by 2.33.

$$\text{Thus: Standard deviation} = \frac{\bar{\bar{R}}}{2.33}$$

Note: The factor 2.33 is based on sub-group size of 5

5.3.3.8.5 COMPUTATION OF CHARACTERISTIC AVERAGE - The average value of a characteristic (process center) is the arithmetic average of the last 10 sample averages.

$$\text{Thus: } \bar{\bar{X}} = \frac{\bar{X}_1 + \bar{X}_2 \cdots + \bar{X}_{10}}{10}$$

5.3.3.9 OPERATION OF THE VARIABLES SAMPLING PROCEDURE (FOR VARIABLES CHARACTERISTICS FOR WHICH MRSD IS NOT SPECIFIED) - Select the sample in accordance with Table 5.3-2. Compute the median value of the characteristic. If this value is on or between the USLA and the LSLA for the characteristic, accept the lot, for the characteristic under consideration. For these distributions, the MRSD need not be specified.

TABLE 5.3-2
VARIABLES SAMPLING TABLE

NORMAL INSPECTION	LOT SIZE 301 - 3200			Over 3200			REDUCED INSPECTION
VARIABLES INSPECTION LEVEL	n	k	a	n	k	a	VARIABLES INSPECTION LEVEL
V1	15	0.42	3.17	25	0.33	2.98	V1 & V2
V2	35	0.28	2.87	50	0.23	2.78	V3
V3	110	0.16	2.63	225	0.11	2.54	———

5.3.3.10 TECHNICAL NOTES - The following notes are intended to give a more complete understanding of certain phases of the variables sampling plan.

5.3.3.10.1 TYPES OF VARIABLES TESTS - In this variables inspection plan two classes of distribution characteristics are recognized. A unimodal symmetric class and a highly asymmetric class which

may or may not be unimodal. For those characteristics whose proper distribution is considered to be of the first class, a MRSD shall be specified on the TSS, and the procedure of paragraph 5.3.3.8 shall apply. For those characteristics whose proper distribution is considered to be of the second class, no MRSD shall be specified, and the procedure of paragraph 5.3.3.9 shall apply. This classification of characteristics is determined prior to the designation on the TSS. In no case will it be necessary to demonstrate the class of a distribution of a characteristic of a particular lot to the Service Inspector.

5.3.3.10.2 VARIABLES INSPECTION LEVEL - The use of Variables Inspection Levels permits the specifying body to obtain various degrees of assurance that the specified lot parameters will be met. The discrimination of a sampling plan (i.e. the ability to differentiate between good and bad lots) is measured in terms of the number of Maximum Rated Standard Deviations between the process averages of lots which are acceptable 95% of the time and those acceptable 10% of the time. Table 5.3-3 shows how discrimination relates to Variables Inspection Level, lot size, and type of inspection.

Table 5.3-3

DISCRIMINATION VALUES			
NORMAL INSPECTION	LOT SIZE		REDUCED INSPECTION
VARIABLES INSPECTION LEVEL	301 - 3200	Over 3200	VARIABLES INSPECTION LEVEL
V1	0.8	0.6	V1 & V2
V2	0.5	0.4	V3
V3	0.3	0.2	———

5.3.3.10.3 FACTOR "a" - The Maximum Rated Standard Deviation of any unimodal symmetrically distributed characteristic to be measured on a variables basis shall be designated on the tube specification sheet. In order to simplify the acceptance sampling procedure a method utilizing the range of the sample has been developed. Factor "a" is a factor which converts sampling variations in terms of standard deviation to sampling variations in terms of range.

Factor "a" has been derived so as to give 95% assurance of acceptance if the true standard deviation of the lot is equal to the maximum rated standard deviation. (For further information see "The Best Unbiased Estimate of Population Standard Deviation Based on Group Ranges" by F.E. Grubbs and C.L. Weaver in JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION, June 1947 issue.)

5.3.3.10.4 FACTOR "k" - The "k" factor is used in obtaining the Acceptance Limit for Sample Averages. This "k" factor has been derived so as to assure 95% acceptance of lots whose true average is equal to the Specification Limit for Averages of Acceptable Lots.

Mathematically "k" $\frac{1.64}{\sqrt{n}}$ Where 1.64 is taken from tables of areas of a normal distribution associated with 5%.

5.3.4 LIFE TEST SAMPLING PROCEDURE

5.3.4.1 MEANS OF ASSURING QUALITY - The procedure for assuring the maintenance of a desirable quality level consists of a series of normal, reduced and tightened inspection plans for use at 100 hours and a fixed inspection plan at 500 hours. The sample size is dependent upon lot size, and the transfer between normal, reduced and tightened inspection is dependent upon quality history.

5.3.4.2 SELECTION OF INSPECTION SCHEME - LIFE TEST SAMPLE "A"

5.3.4.2.1 NORMAL INSPECTION - Normal inspection shall be used initially and shall be continued until reduced or tightened inspection is used.

5.3.4.2.2 REDUCED INSPECTION - Reduced inspection may be used if the conditions for reduced inspection specified in MIL-STD-105A (par. 9.3.3) are met, or if no lot in the last 20 lots inspected shall have been declared non-conforming for life test qualities.

A tube type that has qualified for reduced inspection shall revert to normal inspection under either of the following conditions:

(1) If a lot is indicated to be non-conforming by the reduced inspection plan.

(2) If the percent defective, as computed from the combined initial Life Test Sample "A" of the last ten (10) lots is greater than the specified AQL.

The conditions for requalification for reduced inspection shall be the same as for initial qualification for reduced inspection.

5.3.4.2.3 TIGHTENED INSPECTION - Tightened inspection shall be used when called for by MIL-STD-105A, (paragraph 9.3.2) or when two or more lots in the last ten lots inspected are declared non-conforming for life test qualities.

Tightened inspection shall be used to re-evaluate the quality of any lot previously declared non-conforming.

Normal inspection may replace tightened inspection in accordance with the provisions of MIL-STD-105A.

5.3.4.3 SELECTION OF SAMPLING PLANS - The requisite rates of failure (AQL's) and allowable shifts shall be designated as acceptance inspection conditions on the applicable tube specification sheets.

5.3.4.3.1 LIFE TEST SAMPLE "A" - The sampling plans used with Life Test Sample "A" shall be as follows:

5.3.4.3.1.1 NORMAL INSPECTION PLAN - The sampling plan used in conjunction with Life Test Sample "A" when normal inspection is in effect shall be selected by using Inspection Level II in Table III of MIL-STD-105A to determine the Sample Size Code Letter and Table IV-A (Single Sampling) or Table IV-B (Double Sampling) to determine the actual sampling plan.

When obtaining Sample Size Code Letters, any lot containing between 301 and 800 tubes shall be considered to consist of 800 tubes, and any lot containing more than 8000 tubes shall be considered to consist of 8001 tubes.

Either single or double sampling may be used at the option of the manufacturer. Multiple sampling is not recommended for this application because of the time element.

5.3.4.3.1.2 REDUCED INSPECTION PLAN - The sampling plan used in conjunction with Life Test Sample "A" when reduced inspection is in effect shall be selected by using Inspection Level II in Table III of MIL-STD-105A to determine the Sample Size Code Letter and Table V to determine the actual sampling plan.

When obtaining Sample Size Code Letters, any lot containing between 301 and 800 tubes shall be considered to consist of 800 tubes, and any lot containing more than 8000 tubes shall be considered to consist of 8001 tubes.

If the indicated sample is less than 22 tubes, the actual sampling plan shall be that called for by use of the specified AQL and sample size code letter "K". This will provide a sample size of at least 22 tubes except for an AQL of 0.15%. In this particular case sample size code letter "L" shall be used.

5.3.4.3.1.3 TIGHTENED INSPECTION PLAN - The sampling plan used in conjunction with Life Test Sample "A" when tightened inspection is in effect shall be selected by using Inspection Level II in Table III of MIL-STD-105A to determine the Sample Size Code Letter and the tightened sampling plans in Table IV-A (Single sampling) or Table IV-B (double sampling) to determine the actual sampling plan.

When obtaining Sample Size Code Letters, any lot containing between 301 and 800 tubes shall be considered to consist of 800 tubes, and any lot containing more than 8000 tubes shall be considered to consist of 8001 tubes.

Either single or double sampling may be used at the option of the manufacturer.

5.3.4.3.2 LIFE TEST SAMPLE "B" - The sampling plans used with Life Test Sample "B" shall be as follows.

5.3.4.3.2.1 ATTRIBUTES TEST - If more than 2 tubes of Life Test Sample "B" become defective during the life test, the lot represented by Life Test Sample "B" shall be declared non-conforming.

5.3.4.3.2.2 VARIABLES TEST - The average of the percentage change of the life test characteristics of Life Test Sample "B" which have designated allowable shifts shall not exceed such allowable shifts. If any of the allowable shifts are exceeded, the lot represented by Life Test Sample "B" shall be declared non-conforming. In computing the average value of life test characteristics, no inoperative tubes shall be used.

5.3.4.4 SELECTION AND DISPOSITION OF SAMPLES

5.3.4.4.1 LIFE TEST SAMPLE "A" - Life Test Sample "A" shall be selected from the lot at random in such a manner as to be representative of the lot. If such selection results in a sample containing one or more tubes which are outside the initial specification limits or which contain mechanical defects, such tubes shall be replaced by randomly selected good tubes. The selection of tubes for Life Test Sample "A" shall be made in a manner approved by the Service's inspector.

At the end of 100 hours those tubes which meet the initial test requirements shall not be considered to have undergone a destructive test.

5.3.4.4.2 LIFE TEST SAMPLE "B" - Life Test Sample "B" shall be selected prior to the start of the life test by serially numbering 25 tubes selected at random from Life Test Sample "A". The 20 tubes having the lowest serial numbers which successfully complete the first 100 hours of life shall be used as life Test sample "B"

At the end of 500 hours Life Test Sample "B" shall be considered for Service use to have undergone a destructive test.

5.3.4.4.3 LIFE TEST SAMPLE "C" - Life Test Sample "C" shall be selected from Life Test Sample "B". The 10 tubes having the lowest serial numbers which successfully complete the first 500 hours of life shall be used as Life Test Sample "C".

Life Test Sample "C" shall be considered for Service use to have undergone a destructive test.

Life Test "C" shall be conducted for information purposes only, and it shall not be considered an acceptance test. Five copies of test data for Life Test Sample C shall be forwarded to the Armed Services Electron Tube Committee Secretariat at the Armed Services Electro Standards Agency, Fort Monmouth, N. J.

5.3.4.5 INSPECTION PROCEDURE - The inspection procedure shall be as follows and in the order given.

a. Select Life Test Sample "A"

b. Select and mark serially the 25 tubes from which Life Test Sample "B" is to be selected.

c. Record the values of designated life test characteristics of the 25 serially numbered tubes.

d. If one hour test is designated record the values of the required characteristics of all tubes in Life Test Sample "A".

e. Run Life Test Sample "A" for 100 hours under specified life test conditions with an intermediate reading period of 40 hours for the serially numbered tubes.

f. Determine the number of defective tubes which occurred during the 100 hour period, including any defectives which may have occurred at the one hour test.

g. If more than the allowable number of defective tubes have occurred, declare the lot non-conforming.

h. If no more than the allowable number of defective tubes have occurred, select Life Test Sample "B".

i. Record for each tube the initial value of specified life test characteristics for Life Test Sample "B" for those characteristics having designated allowable shifts.

j. Run Life Test Sample "B" to a cumulative total of 500 hours under specified life test conditions with an intermediate reading at 300 hours.

k. Determine the number of defective tubes which have occurred in Life Test Sample "B" during the 400 hours of additional operation.

l. If more than 2 tubes have become defective, declare the lot non-conforming.

m. Record values of the life test characteristics of life test sample "B" at 500 hours and compute the absolute percentage change referenced to the zero hour reading for each tube on those characteristics having a designated allowable shift. The average allowable shift shall be the average of the individual absolute percentage changes. The readings of defective tubes shall not be used in these computations.

n. If the average value of any life test characteristic differs by more than the allowable shift specified, declare the lot non-conforming for life test qualities.

o. If no more than the allowable number of defectives have occurred, and if the average value of each life test characteristic does not differ by more than the allowable shift from its initial average, accept the lot for life test qualities.

p. Select Life Test Sample "C"

q. Run Life Test Sample "C" for an additional 500 hours (a total of 1000 hours life test) and record results for information purposes only.

5.3.4.6 NON-CONFORMING LOTS - Lots found non-conforming for Life Test "A" may be resubmitted for acceptance through the use of the tightened inspection procedure. Lots found non-conforming on Life Test Sample "B" may be resubmitted only after reprocessing of the lot has been performed.

5.3.5 ACCEPTANCE SAMPLING PROCEDURE FOR MINIATURE TUBE BASE STRAIN TEST

5.3.5.1 SAMPLING PROCEDURE - The sample shall consist of 30 tubes taken at random from the production of each sealing and exhaust unit. This sample size, n = 30, shall be used for both Stricter and Normal Testing.

For Normal Testing, the sample shall be taken twice during each regular work shift.

For Stricter Testing, the sample shall be taken every hour.

In either case, the first sample shall be taken at the start of each work shift. Stricter Testing shall be in effect initially and shall continue in effect until the criteria for Normal Testing have been met.

5.3.5.2 QUALIFICATION FOR NORMAL TESTING - A unit shall qualify for Normal Testing only when all of the following requirements have been met:

a. There has been no change of tube type on the unit during the testing of the last five samples required for qualifying;

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

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

5.3.5.3 TESTING - Test the sample in accordance with procedure of paragraph 4.9.6.1 of MIL-E-1B. Defects are:

GROUP	DEFECT
A	Bulb and/or Tip Cracks
B	Button Cracks
C	Seal Cracks

A defective tube is any tube which shows one or more of these defects.

5.3.5.4 ACCEPTANCE AND REJECTION CRITERIA - The production lot represented by the sample shall be:

a. Accepted if not more than three defectives for "A", "B", or "C" defects respectively, or if not more than four total defectives are found in the sample

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

5.3.5.5 RECORDS - A record of all defectives shall be maintained for each sealing and exhaust unit. This record shll 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.

5.3.5.6 ACTION TO BE TAKEN ON REJECTED LOTS - If a lot is rejected on this test, all production from this exhaust unit during the period between the present and previous samples shall be 100% strain tested for that class of defect which caused rejection.

NOTE: 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.

5.3.6 ACCEPTANCE SAMPLING PROCEDURE FOR SHORT AND CONTINUITY TEST

5.3.6.1 BASIS FOR ACCEPTANCE - An Acceptable Quality Level (AQL) of 0.4% is the basis of the acceptance sampling procedure for inoperatives (shorts, discontinuities, and *air leaks). The number of defectives found in the sample tubes will determine whether or not each lot is to be accepted for this test item according to the criteria of the sampling plans for the Short and Continuity Test, 0.4% AQL, Level II; shown in MIL-STD-105A.

*Any tube which shows a Grid Current reading of 1.0 uAdc or twice the maximum limit for Grid Current whichever is greater, shall be considered as inoperative. (See paragraph 4.7.5 of MIL-E-1B.)

5.3.6.2 SAMPLING PROCEDURE - The sampling procedure provided to assure the AQL of 0.4% includes stricter and normal testing. The conditions which allow or require a change from one testing procedure to another are dependent on the process average. Records shall be maintained from results of acceptance sampling tests for each tube type in order to determine the percent of inoperatives. This percent, calculated to the nearest tenth of one percent is the process average. Only results from first samples from the previous 5 days' production shall be used to determine the process average, but results from resubmitted lots shall be excluded.

5.3.6.2.1 STRICTER TESTING - Stricter testing is in effect:

a. On new production (and initially) until on subsequent lots the type shall have qualified for normal testing and

b. For any type for which the process average exceeds 0.85%.

5.3.6.2.2 NORMAL TESTING - Qualification for normal testing:

When the process average for any type becomes 0.70% or less, stricter testing may be discontinued and normal testing started.

5.3.6.2.3 LOSS OF ELIGIBILITY FOR NORMAL TESTING

When the process average for any type on normal testing exceeds 0.85%, normal testing shall be discontinued and stricter testing resumed.

5.3.6.2.4 NON-CONFORMING LOTS - The manufacturer must reinspect rejected lots 100% for the item involved prior to resubmission of the lot for acceptance.

5.3.7 ACCEPTANCE SAMPLING PROCEDURE FOR HEATER CYCLING LIFE TEST

5.3.7.1 AUTHORIZATION - Each daily lot of tubes is to be sampled and tested in accordance with the provisions of paragraph 4.11.7 of MIL-E-1B and the provisions of the following paragraphs.

5.3.7.2 ACCEPTABILITY - Any tube which shows a heater failure or heater-cathode insulation (Ihk) measurement in excess of the life test end point limit prior to the completion of the cycling test is considered a defective tube. Any tube which has heater continuity and meets the Heater Cycling Life Test End Point limit at completion of the cycling test is considered acceptable. Since the cycling test is classed as a "destructive test" the tubes in the test sample shall be scrapped and only the untested tubes in the lot shall be accepted when acceptable results are shown. The AQL (Acceptable Quality Level) is 1.0% for this test.

5.3.7.3 SAMPLING PROCEDURE - It is desired to maintain a process average of not greater than 1% defective and also to minimize the size of the sample which is scrapped. Accordingly, sampling plans are provided for normal, stricter, and reduced inspection. The conditions under which normal, stricter or reduced sampling plans are to be used are given in paragraphs 5.3.7.3.1, 5.3.7.3.2 and 5.3.7.3.3. A lot-by-lot and summary record shall be kept to show the results of the acceptance inspection for the last ten successive lots in order that the moving average percent of defective tubes may be determined. This percentage of defective tubes, computed from the results of the first samples for the last ten successive lots, and rounded off to the nearest 0.1%, is defined as the process average.

5.3.7.3.1 STRICTER TESTING is a double sampling procedure conducted according to Table 5.3-5. Stricter Testing shall be in effect initially and shall continue until the eligibility criteria for Normal Testing or Reduced Testing have been met.

5.3.7.3.2 NORMAL TESTING - Normal testing shall be conducted according to the double sampling procedure as outlined in table 5.3-6. Eligibility for normal testing is: The process average is greater than 0.7% but does not exceed 1.9%. Loss of eligibility: When the process average exceeds 1.9%, Normal testing shall be discontinued and stricter testing resumed.

5.3.7.3.3 REDUCED TESTING - Reduced testing shall be conducted according to the double sampling procedure outlined in table 5.3-7. Eligibility for reduced testing is: The process average is 0.7% or less. Loss of eligibility: (a)Reduced testing shall be discontinued and normal testing resumed when the process average is greater than 0.7% but does not exceed 1.9%, and at the same time no lot has been rejected; (b)reduced testing shall be discontinued and stricter testing used for subsequent lots whenever a lot is rejected, or the process average is greater than 1.9%.

SAMPLING TABLES FOR HEATER CYCLING TEST

Table 5.3-5 Stricter Testing

Lot Size N	Sample Size 1st Sample n1	2nd Sample n2	Total Sample n_1+n_2	Acceptance Numbers In 1st Sample Ac_1	In Total Sample Ac_2
Less than 801	25	50	75	0	1
801-3200	50	100	150	0	2
3201 and over	50	100	150	0	2

Table 5.3-6 Normal Testing

Lot Size N	Sample Size 1st Sample n_1	2nd Sample n_2	Total Sample n_1+n_2	Acceptance Numbers In 1st Sample Ac1	In Total Sample Ac2
Less than 801	15	30	45	0	1
801-3200	15	30	45	0	2
3201 and over	25	50	75	1	3

Table 5.3-7 Reduced Testing					
	Sample Size			Acceptance Numbers	
Lot Size N	1st Sample n_1	2nd Sample n_2	Total Sample n_1+n_2	In 1st Sample Ac_1	In Total Sample Ac_2
Less than 801	15	30	45	0	1
801-3200	15	30	45	0	1
3201 and over	25	50	75	0	2

5.3.8 CRITERIA FOR ACCEPTANCE AND REJECTION - VISUAL AND MECHANICAL INSPECTION OF RELIABLE SUBMINIATURE TUBES

5.3.8.1 INSTRUCTIONS - This section is to be applied to reliable subminiature tubes.

Inspection shall be in accordance with MIL-STD-105, Inspection Level I.

	TYPE OF DEFECT	AQL (% DEFECTIVE)
Major	- For all tubes in sample	-0.4 combined.
Minor A	-For all tubes in sample	-2.5 combined.
Minor B	-For each defect	-6.5 per defect.

Inspect using 5- to 10-power magnification for the defects as described in 5.3.8.2 through 5.3.8.1.6. Use 10- power magnification for defects as described in 5.3.8.17 through 5.3.8.28

5.3.8.2 TIP DEFECTS

5.3.8.2.1 BENT AND LONG TIPS - Tube does not pass through proper gage. Minor A

5.3.8.2.2 SHARP TIPS - Tip is sharp, chipped, or stringy. Minor A

5.3.8.2.3 SUCKED-IN TIPS - Glass is sucked back into envelope. (Note: This defect is not to be confused with slight indentation.) Minor A

5.3.8.3 LONG OR SHORT BULBS - Tube does not pass through proper gage. Minor A

5.3.8.4 CRACKED DOME, BULB, OR HEADER - A crack extends into or through the wall of the glass envelope. (Note: Debatable cracks and checks are to be judged by mechanical thermal shock or other accepted methods.) Accept if: Checks in the header between leads do not extend more than half way through the header measured from the outside header surface. Major

5.3.8.5 POOR, MISSING, OR WRONG ETCH OR BRAND - Etch or brand is incorrect, or, etch or brand is not legible so that it fails to meet the rub test specified in paragraph 6.2.5.1 Major

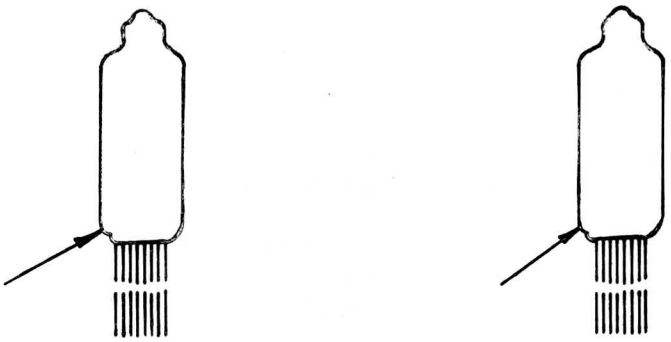
5.3.8.6 CHIPPED-OUT SECTION OF GLASS - There are any chips on the straight portion of the bulb, or on the doughnut or header. Minor A

Accept if: Small chips occur around leads, which are generally caused by chipping of glass flash or by glass build-up around the leads. In no case shall chip extend beyond one lead diameter from the lead. Minor B

5.3.8.7 DIRTY TUBES - Tubes have foreign material adhering to the outside surface; or, globules of tin are adhered to the header or the untinned portion of the leads. Minor A

5.3.8.8 LARGE DIAMETER SEALS AND BULBS - Tubes do not enter proper outline gage. Minor A

5.3.8.9 OFF-CENTER SEALS - Any portion of the header extends out beyond the normal bulb outline at any point on the periphery of the bulb. Also if the bulb extends out over the header, and the angle that the bottom of the bulb makes with the header is sharp, or approximately 90 degrees (See drawing "a"). Accept if: There is a fillet between the bottom of the bulb and the header. (See drawing "b"). Minor A



(a) (b)

5.3.8.10 PLANE OF HEADER WITH RESPECT TO BULB - The plane of the header exceeds an angle of 5 degrees with respect to the horizontal when the long dimension of the tube is in a vertical position. (Reference line is taken diametrically across the highest point at the bottom of the header.) Minor A

5.3.8.11 MISSING LEADS - There are any missing leads which should normally be a part of the finished tube. Major

5.3.8.12 STRAIGHTNESS OF LEADS - Leads are tangled, knotted, twisted, or kinked. Accept if: Leads are reasonably straight. Minor A

5.3.8.13 TINNING DEFECTS

5.3.8.13.1 POOR TINNING - A bare spot encircles the leads, or if any bare spot is more than 1 millimeter long. Minor A

5.3.8.13.2 EXCESSIVE TINNING - The maximum lead diameter is exceeded, or is less than that specified in the outline drawing from 0.050-inch to 0.250-inch from the base of the tube; or the lead diameter from 0.250-inch to 1.50 inches from the base of the tube, exceeds the maximum diameter of 0.021-inch using a micrometer for measurement. Minor A

5.3.8.13.3 LUMPY TINNING - Accept if: The lead diameter of individual spots, not impairing the flexibility of the leads, does not exceed 1-1/2 times the bogie lead diameter. (This is only an appearance defect.) Minor B

5.3.8.13.4 INCOMPLETE TINNING - Tinned portion of the lead does not extend to within 0.050-inch of the header. Minor A

5.3.8.14 LEAD LENGTH - Lead length does not meet length specified by outline drawing. Minor A

5.3.8.15 BURNED DUMET LEADS - Copper sheath has been burned through. Minor A

5.3.8.16 CORROSION (HEADER AND LEADS) - There is 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 A

5.3.8.17 BURNT GRID LATERAL WIRES - A specified grid half-turn or turns is burnt through. Minor A

5.3.8.18 MISSING POINTS ON MICA - More than one mica point is missing on the mount (top and bottom mica). Minor B

5.3.8.19 NEAR SHORTS - Any elements outside the top and bottom mica are distorted so that they are very close. (Note - Minimum allowable separation on premium types will be .010-inch.) Minor B

5.3.8.20 WELDS- OPEN - Any weld is obviously open. Major

5.3.8.21 WELDS - OTHER DEFECTS - Any welded element is reduced by more than 1/2 its original area of cross-section; or dangling particles occur formed by over-welding and partial mutilation of an element; or particles or spattered weld metal cling to any element other than the original weld area. Minor B

5.3.8.22 HEATER-COATING DEFECTS - Heater-coating on heater or heater legs is missing or damaged at the entrance to the cathode sleeve. Minor A

5.3.8.23 MISSING PARTS - Any specified constructional part of the mount is missing. Major

5.3.8.24 LOOSE PARTICLES - There are any loose conducting particles in the bulb; or any particles are present, whose identity cannot be determined. Major
However, any non-conducting particles which are present, whose maximum dimension is greater than 1/16-inch is a lesser defect. Minor B

5.3.8.25 METAL TOUCHING BULB - All cases of metal touching glass as identified by a white spot or check appearing on the straight portion of the bulb; or, metal touches the dome or seal, as indicated by a white spot. Major

5.3.8.26 METALLIC PARTICLES IMBEDDED ON INSIDE OF BULB - All degrees of this defect shall be rejected since these are generally getter pellets or cases. Minor A

5.3.8.27 GETTER FLASH - There is no indication of getter flash on the surface of the bulb, or if the area covered by the getter flash is less than 16 square millimeters. Major

5.3.8.28 GETTER PEEL - There is any sign of getter peel parted from the bulb over an area in excess of .031-inch maximum dimension. (Note: Usually identified as a blister.) Accept if: Getter windows are present in the getter area. Minor A

5.3.8.29 SUMMARY OF DEFECTS - The following table summarizes the visual and mechanical defects for reliable subminiature tubes as indicated in the above paragraphs.

SUMMARY LISTING OF DEFECTS

	DEFECTS	MAJOR	MINOR A	MINOR B
5.3.8.2	Tip Defects			
	Bent and Long Tips		X	
	Sharp Tips		X	
	Sucked in Tips		X	
5.3.8.3	Long or Short Bulbs		X	
5.3.8.4	Cracked Dome, Bulb, or Header	X		
5.3.8.5	Poor, Missing, or Wrong Etch or Brand	X		
5.3.8.6	Chipped Out Section of Glass		X	X
5.3.8.7	Dirty Tubes		X	
5.3.8.8.	Large Diameter Seals and Bulbs		X	
5.3.8.9	Off Center Seals		X	
5.3.8.10	Plane of Header With Respect to Bulb		X	
5.3.8.11	Missing Leads			
5.3.8.12	Straightness of Leads		X	
5.3.8.13	Tinning Defects			
	Poor Tinning		X	
	Excessive Tinning		X	
	Lumpy Tinning			X
	Incomplete Tinning		X	

	DEFECTS	MAJOR	MINOR A	MINOR B
5.3.8.14	Lead Length		X	
5.3.8.15	Burnt Dumet Leads		X	
5.3.8.16	Corrosion		X	
5.3.8.17	Burnt Grid Lateral		X	
5.3.8.18	Missing Point on Mica			X
5.3.8.19	Near Shorts		X	
5.3.8.20	Weld - Open	X		
5.3.8.21	Welds - Other Defects			X
5.3.8.22	Heater - Coating Defects		X	
5.3.8.23	Missing Parts	X		
5.3.8.24	Loose Particles Conducting Non-Conducting Unidentified	 X X		 X
5.3.8.25	Metal Touching Bulb	X		
5.3.8.26	Metallic Particles Imbedded on Inside of Plate		X	
5.3.8.27	Getter Flash	X		
5.3.8.28	Getter Peel		X	

5.4 TRANSMITTING TYPE ELECTRON TUBES -*

5.5 HIGH VOLTAGE, HIGH VACUUM RECTIFIERS -*

5.6 CRITERIA FOR ACCEPTANCE AND REJECTION - CATHODE RAY TUBES

5.6.1 INSTRUCTIONS - This Section is to be applied to tubes of questionable quality only.

Before inspection clean the face of the tube with a suitable cleaner.

Inspect by looking directly at glass of tube. Do not use a transparent material to aid in segregating areas of face. Use suitable mask placed directly upon glass surface with a 2 inch diameter circular cutout. The line of vision should be normal to the surface of the tube at the point under observation.

5.6.2 GLASS DEFECTS -*

5.6.3 SCREEN DEFECTS - Examine screen with spot defocused to cover entire face of tube.

5.6.3.1 BRIGHT SPOT - A point-like source of light with an intensity 2 or 3 times that of the surrounding area. Reject if: there are any having a dimension greater than 2 mm; if, within any 2-inch diameter circle, there are more than 2 having a dimension greater than 1 mm; if, within any 2-inch diameter circle there are more than 3 having a diameter greater than .4 mm. (Do not consider bright spots having dimensions less than .4 mm). See 5.6.3.3

5.6.3.2 BRILLIANT SPOTS - A point-like source of light which has an intensity far in excess of the surrounding area. Reject if: there are any having a dimension greater than 1 mm; if, in any 2-inch diameter circle, there are more than 1 having a dimension greater than .4 mm; if, in any 2-inch diameter circle, there are more than 4 having a dimension greater than .2 mm. (Do not consider brilliant spots having dimensions less than .2 mm.) See 5.6.3.3

5.6.3.3 DEAD SPOTS - These are non-fluorescent spots which are dark in the center. (If they have a ring of light completely around the spot they are classified as bright or brilliant spots). Reject if: there are any having a dimension greater than 1.5 mm; if, in any 2-inch diameter circle there are more than 1 having a dimension greater than 1 mm; if, in any 2-inch diameter circle there are more than 4 having a dimension greater than .4 mm. (Do not consider dead spots under .4 mm diameter or dead lines under .1 mm width).

5.6.3.4 COLOR SPOTS - Uniform non-phosphorescent color spots (color spots which phosphoresce are to be considered under shaded and mottled areas). Reject if: there are any having a dimension greater than 2 mm; if, in any 2-inch diameter circle there are more than 2 having a dimension greater than 1 mm. (Do not consider color spots having a dimension less than 1 mm).

5.6.3.5 SHADED AND MOTTLED AREAS - These are gradations in color or light intensity with respect to the general overall screen background. Reject if: area in which phosphorescent light output differs by a factor greater than 2 is in excess of 20 sq. mm.

5.6.3.6 WATER AND SIPHON MARKS - These are variations in thickness of screen materials around perimeter of screen. Reject if: area extends inside minimum useful screen area.

5.7 GAS TUBES -*

5.8 SEMI-CONDUCTORS -*

5.9 KLYSTRONS

5.9.1 MECHANICAL INSPECTION -*

5.9.2 ELECTRICAL INSPECTION

5.9.2.1 BROAD BAND TESTING

5.9.2.1.1 TESTING CIRCUIT - The assembly of the broad-band testing circuit is shown in drawing attached to tube specification sheet. This load consists of the following components:

(1) Tube Insertion Section
(2) Attenuator and Standing Wave Introducer
(3) Wavemeter Section
(4) Y Joint
(5) Crystal Converter.
(6) Thermistor Wattmeter
(7) Transformers

5.9.2.1.1.1 TUBE INSERTION SECTION - This consists of a saddle constructed so that a tube coaxial with a minimum length outer conductor penetrates into the guide so that the full length of the antenna is exposed within the guide. The tube is inserted in the wave guide through a choke joint to insure a good high frequency contact to the coaxial without the necessity of depending upon the metallic contact. From time to time it will be necessary to replace the polystyrene bushing. The broad-band characteristics of this section are determined by the offset of the probe entrance in the guide and the distance from the probe center to the backing plate. These should not be altered since it will be a requirement on the tube that it will be broad-band with the adjustments as specified. The offset of the coaxial center from the wave guide axis should be .178 inches. The distance from the back plate to the center of the coaxial should be .394 inches. It is imperative that the end plug should metallically seal the valve guide. A detail drawing of this section is shown in the test circuit on drawing attached to tube specification sheet.

5.9.2.1.1.2 ATTENUATOR AND STANDING WAVE INTRODUCER - The broad-band characteristics of this section are determined by the taper of the card resistor. It should be set at 13.0 db and locked. Periodic checks of this setting should be made. The resistance per square of the card resistors is a manufacturing variable which may produce in some cases a variation of attenuation with frequency. This variation over the frequency range should not exceed .5 db from the 13.0 db value. The standing wave introducer consists of a slotted section of guide carrying a place riding on ways. The plate makes electrical connection to the guide by means of a half wave choke. Mounted on this plate is a stub which can be set for either an "in" or "out" position. This stub makes electrical contact with the plate by means of a half wave choke. In the "in" position the depth of penetration of the probe and hence the magnitude of the "in" position standing wave may be adjusted by means of the screw setting. Ideally, the magnitude of the standing wave for the "in" position should be independent of the position of the slide. However, because of standing waves from other reflections, the standing wave seen by the tube will vary both in mag-

nitude and phase. After the attenuator has been set at 13.0 db in the center of the band, the generator should be tuned to the frequency of the pulling test. Using a standing wave detector, the standing wave for the "in" position should be adjusted so that the mean of values for all phases is 8 db and the lock-nut should be set. The deviation from this value should not exceed $\pm$ .5 db. For the "out" position the SWR looking into this unit when it is terminated in a match should not exceed .8 db.

5.9.2.1.1.3 WAVEMETER SECTION - The side chambers are tuned to opposite ends of the frequency band of the tube at which they absorb energy from the guide to provide test limits. The plungers permit detuning to facilitate location of frequency and also to permit power measurement without loss at these points. Care should be taken to insure that the plungers return home when released. The tuning screws should be well fitted in to the threads.

5.9.2.1.1.4 Y JOINTS - No adjustment is necessary on this unit. In the course of use, the sliding shutters should be periodically checked to insure that they make good contact with the gates. In operation, only one gate should be open at a time. Under these circumstances they will present very little discontinuity when either arm is terminated in characteristic impedance.

5.9.2.1.1.5 CRYSTAL CONVERTER - This unit is designed to employ a 1N23B crystal. After assembly, the unit should be coupled to a suitable CW source through an attenuator adjusted so that the power into the converter is 1 milliwatt. A standing wave detector should be inserted between the attenuator and the crystal. In assembling the crystal detector, care should be taken to insure that the crystal seats home. The frequency of the source should be adjusted to mid-band. The back piston of the converter should then be adjusted for maximum current through a meter having approximately 18 ohms resistance. The standing wave produced by the crystal can be adjusted by means of the back piston. This standing wave should not exceed 6 db throughout the band. The piston should be locked after adjustment. Some selection of crystals may be necessary to insure uniform response over the frequency range.

It is imperative that the crystal detector should be operated into approximately 18 ohms for its broadband characteristics and its protection against surges. Soldering irons should never be brought in contact with the crystal converter housing. Unnecessary handling of the converter should be avoided. If on any occasion it is necessary to open the unit, care should be taken to shield the crystal from extraneous rf radiation by a metal screen.

5.9.2.1.1.6 THERMISTOR WATTMETER - This unit is a part of the TS36/AP power meter. The wattmeter should be connected into a bridge circuit capable of maintaining a fixed resistance regardless of the power level measured. The wattmeter should be adjusted at the fixed resistance so that over the required band the standing wave ratio does not exceed 3.5 db. There are two adjustments available;

the wave guide screw and a coaxial piston. The power source should be set at a frequency at the middle of the band and the two adjustments made cooperatively to give a maximum power indication. The final adjustment at midband can then be made to provide a minimum standing wave ratio. The standing wave ratio should then be checked at the end of the band and after trimming the adjustments to meet the standing wave ratio requirement, the adjustment should be locked. No requirement is placed on the resistance at which the thermistor should operate except that it should be sufficiently low to make possible measurement of the maximum power expected. Values of 100 or 200 ohms have been found suitable.

5.9.2.1.1.7 TRANSFORMERS - These are nonadjustable devices which permit transition between components constructed in large wave guide and components constructed in small guide.

5.9.2.1.2 PROCEDURE OF TEST

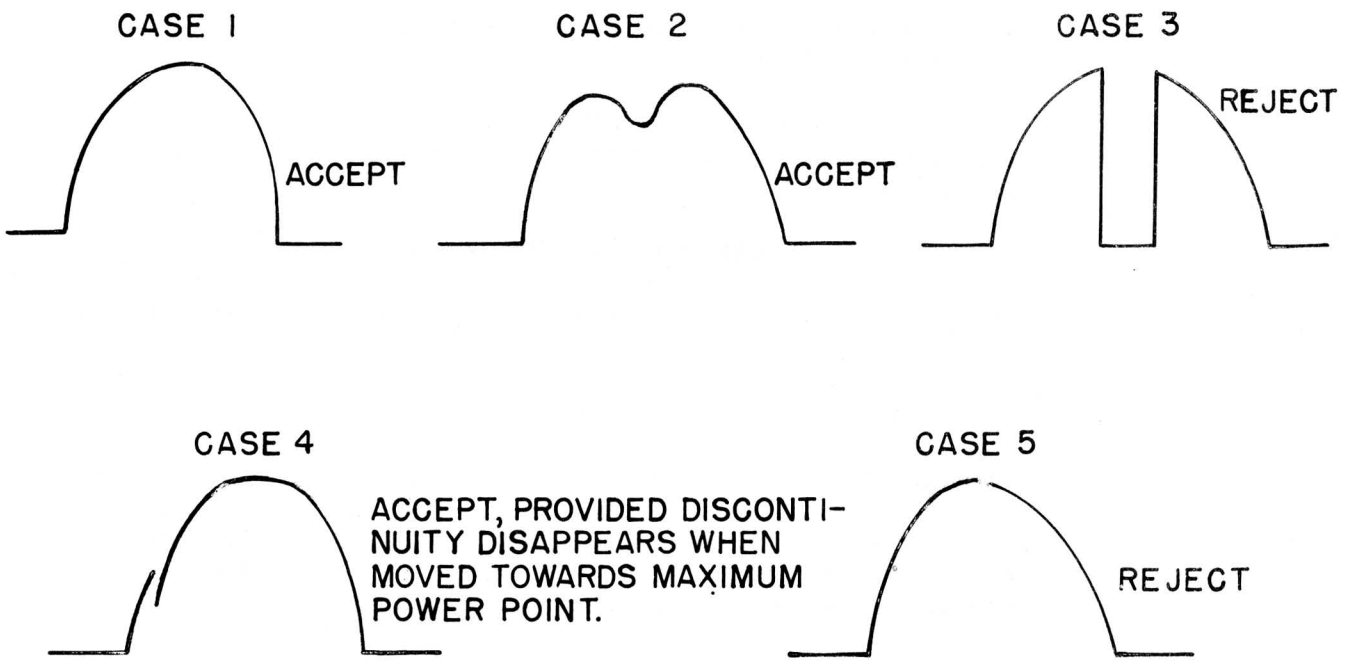
5.9.2.1.2.1 CALIBRATION - When the unit has been assembled and adjusted as described above, it is ready for operation. Close the crystal detector shutter and open the thermistor shutter. The stnading wave introducer should be in the "out" position, that is, plunger up. Adjust the tube under test to the midband frequency (it may be convenient to maintain a standard tube whose frequency is permanently adjusted to mad-band for this setting), and adjust the repeller and resonator voltage until the power meter indicates a maximum power of 1 milliwatt. Close the thermistor shutter, open the crystal converter shutter, and turn on the repeller sweep. The output of the crystal detector operating into an 18-ohm resistor should be fed through an amplifier to the vertical plates on the oscilloscope, while to the horizontal plates on the oscilloscope the repeller sweep is applied. Adjust the oscilloscope vertical gain until the peak deflection is 20 divisions. The oscilloscope deflection is then approximately a direct indication of power output. This is approximate because the current from the crystal is not exactly proportional to the power input. The repeller sweep should be adjusted so that only one mode appears on the screen. The unit is then ready to test tubes.

5.9.2.1.2.2 TEST - The tube under test should be inserted in the test circuit and normal voltages applied as specified. With the repeller sweep on and adjusted to present only one mode on the oscilloscope screen, the tuning screw should be manipulated to shift the frequency through the band. The wave meter units will indicate the band limits and the mechanical tuning range of the tube should be sufficiently great so that the wavemeter pips can be made to appear centered in the characteristic. The indicated power level over the band should not fall below the value specified for the test. At the end points, the wavemeters may be detuned to determine the true power level. If a tube fails to indicate a sufficient power level on the oscilloscope at any point, it may be checked by centering the pattern on the oscilloscope, switching off the sweep and transferring to the thermistor wattmeter. The thermistor wattmeter will be the final criterion for the rejection of a tube for power output.

In addition to providing power above or equal to the minimum value, the tube output should be free from discontinuous breaks in the characteristic. Since some hysteresis is present in a klystron, care should be taken to differentiate between this phenomenon and discontinuities caused by shorting loops, broken grid wires, etc.

5.9.2.1.2.3 PULLING TEST - The purpose of this note is to expand the information provided by the note in the test specification. The tube should be tuned to the frequency required by the test specification with the introducer set in the "out" position. The output of the crystal should be observed on the oscilloscope as a function of the repeller sweep. The introducer should then be depressed to its stop and moved through all phases (that is, at least 2.5 cm motion) while the oscilloscope pattern is observed.

5.9.2.1.3 CONDITIONS FOR ACCEPTANCE OR REJECTION - The figures below (5.9.2.1.3.1) illustrate conditions for acceptance or rejection. It will be found that the amplitude of the pattern and its shape will vary with the phase of the standing wave. If for any phase the pattern has the form of Case 1, it is acceptable. If for some phase the pattern assumes the form of Case 2, the tube is acceptable provided that a wavemeter pip moves continuously through the pattern as the wavemeter tunes. If the wavemeter pip disappears for an interval at the center of the pattern, the tube should be rejected since this indicates a range of frequencies where the tube will not oscillate. Cases of this type are illustrated by Cases 3 and 5. In some cases it will be found that a discontinuity will appear on the side of the pattern but as the standing wave introducer phase is shifted this will move towards the maximum power point and disappear. If this occurs, the tube is acceptable; if not, and the condition persists as in Case 5, the tube should be rejected.



5.10 MAGNETRONS

5.10.1 DEFINITIONS -*

5.10.2 CRITERIA FOR ACCEPTANCE AND REJECTION

5.10.3 LOOSE PARTICLES IN MAGNETRONS - Magnetrons which contain small particles which would not interfere with the operation of the magnetron will be accepted. Indication of excessive loose cathode coating or the presence of flakes larger than 1/16 inch x 1/16 inch will be cause for rejection. Evidence of metallic particles will normally be considered as cause for rejection. In the event of question of acceptability before rejection, the magnetron will be vibrated in such a manner as to place the metallic particles in the most unfavorable position, normally in the anode space; if the performance of the magnetron is then satisfactory, the magnetron will be accepted. Upon evidence of particles which are indicative of a latent defect, the magnetron will be rejected unless it has been determined by life and vibration tests to be a harmless condition.

5.11 PHOTOTUBES -*

5.12 TR, ATR AND PRE-TR TUBES -*

6. ELECTRON TUBE DESIGNATION AND MARKING

6.1 DESIGNATION

6.1.1 GENERAL - All tubes procured under Military Specification MIL-E-1B for Electron Tubes shall be prefixed by JAN followed by the designations as described in paragraphs 6.1.2 and 6.1.3. These designations shall be used in all correspondence, markings, etc., in reference to tubes produced under the specification.

6.1.2 QUALIFICATION APPROVED TUBES - Types having qualification approval under specification MIL-E-1B shall be designated as follows:

JAN-( ) - "Type No."

The parentheses shall be replaced by the manufacturer's code name.

Example: JAN-CYZ-6SN7W

This is the Army-Navy-Air Force type designation for a tube having the commercial type number 6SN7W and procured from a manufacturer having the code name CYZ. This designation will signify that qualification approval is granted to the tube type as produced by that manufacturer.

6.1.3 ELECTRON TUBES NOT HAVING QUALIFICATION APPROVAL - All tubes procured from manufacturers not having qualification approval on that specific type of tube, but otherwise meeting all requirements of the JAN Specification shall be designated as follows:

JAN- "Type No."

Example: JAN-6SN7W

The manufacturer's code name which signifies type approval shall not be used.

6.1.4 NON DOMESTIC DESIGNATION - For tubes made in a foreign country and procured under this specification, the phrase "Made in USA" shall be changed accordingly.

6.2 MARKING

6.2.1 GENERAL - There shall be marked on the base, bulb, or shell the name, initials, or trade-mark of only the bona fide tube manufacturer who has contracted under the JAN-1A Specification to directly supply either the Services or their equipment manufacturers with tubes, and at whose plants or establishments the JAN Specification tests have been performed and service inspection made upon such tubes contracted to be supplied. Such marking shall not detract from the JAN type marking. Qualification approval code marking shall always be that of the manufacturer of the tube to whom the qualification approval was issued. The equipment manufacturer's name or trademark shall not appear upon the tube unless the equipment manufacturer and the tube manufacturer supplying the tube for the contract are one and the same.

6.2.2 QUALIFICATION APPROVED TUBES - All tubes having qualification approval procured under this specification shall have marked in a permanent and legible manner on the side wall of the base, or on the envelope of metal, lock-in tubes, or other glass tubes, or on the bulb of tubes without bases, the Army-Navy-Air Force tube type number as follows:

JAN-( )-"Type No." or (JAN)-"Type No."

Example: JAN-CXY-6J5 or JAN CXY-6J5

In the case of samll tubes, including 6H6 and similar tubes, acorn, crystal rectifiers, and tubes of T-6-1/2 bulb outline or smaller, the envelope of the tube may be marked as follows:

JXY-"Type No."

or JXY "Type No."

The code XY being the manufacturer's code name.

Examples: JXY-9002

or JXY
9002

6.2.3 TUBES NOT QUALIFICATION APPROVED - Tubes procured under this specification from a source of supply for which no qualification approval is in effect, except as noted in paragraph 4.2.2 of MIL-E-1B shall be marked in a permanent and legible manner on the side wall of the base, or on the envelope of metal, lock-in tubes, or other glass tubes, or on the bulb of tubes without bases, the Army-Navy-Air Force tube type number as follows:

JAN-"Type No." or JAN

Type No.

Examples: JAN-9002 or JAN
9002

The "JAN" abbreviation marking of "J" may be used only as shown in paragraph 6.2.2. The manufacturer's code name which signifies qualification approval shall not be used on any part of the tube.

6.2.4 RESTRICTION - TUBES PROCURED UNDER A CONTRACT WHICH EITHER PERMITS OR REQUIRES ANY CHANGE IN ANY OF THE CONDITIONS OR REQUIREMENTS OF THE SPECIFICATION SHALL NOT BEAR THE PREFIX "JAN" NOR ANY ABBREVIATION THEREOF.

6.2.5 INK MARKING PERMANENCE

6.2.5.1 PROCEDURE -

a. Tubes to be used for determining marking permanence shall be tested only after a minimum of 72 hours following application of the ink marking.

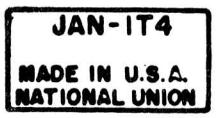
b. Hold a clean soft chamois firmly in the hand, exert as much pressure as possible against the marking and rub over the entire marking twelve times.

c. Marking should be considered satisfactory if it has not worn thin, changed color, developed objectionable ragged edges, or lost appreciable gloss.

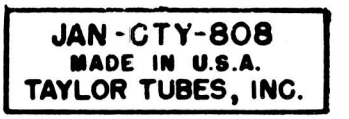
NOTE: Marking permanence tests shall be conducted as standard design tests.

SUGGESTED JAN TUBE MARKING

TUBES WITHOUT QUALIFICATION APPROVAL

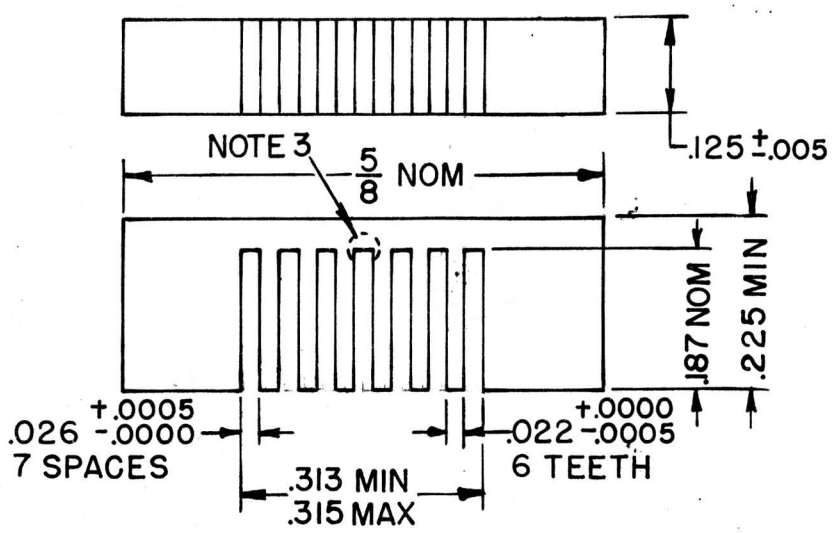


TUBES WITH QUALIFICATION APPROVAL



7. GAGES FOR ELECTRON TUBES

7.1 LEAD SPACING GAGE FOR INLINE LEAD SUBMINIATURE TUBES



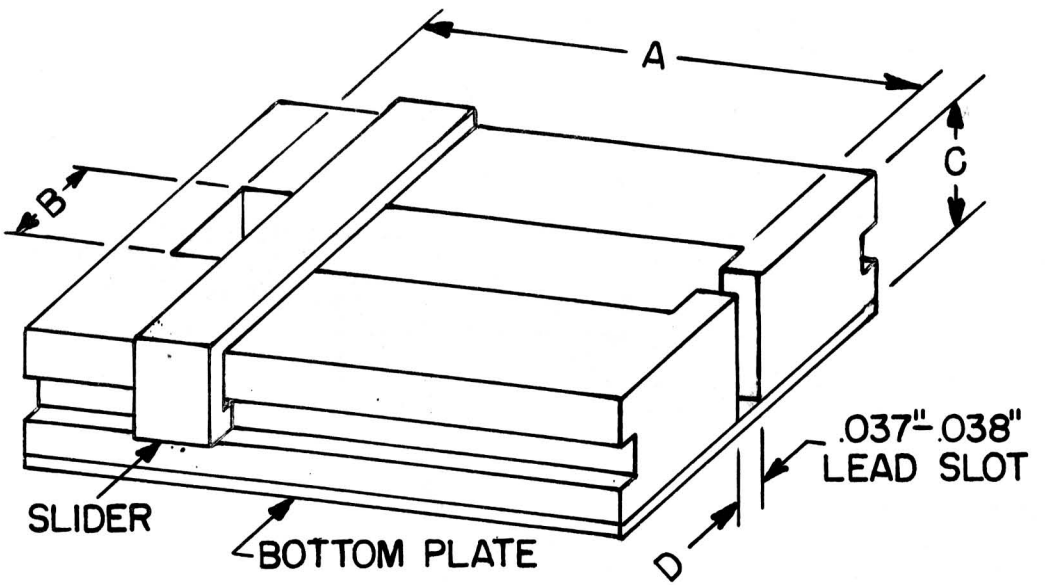
Note 1. All surfaces of teeth relieved with .005" - .010" radius.

Note 2. Mounting on straight extension block or 90° block optional.

Note 3. A single appropriate slot may be enlarged to a lead length not over .050" to provide clearance for a shield ground-lead.

Note 4. Gaging procedure: With tube held with its axis at right angles to face-plane of teeth and the plane of the leads transverse to teeth the leads shall press into slots and some portion of base surface shall bottom against gage when a force not exceeding twenty ounces is applied.

Note 5. This gage is intended as a check on lead spacing on a design check basis only. It is not to be used for 100% checking because it may damage the tin surfaces of the leads.



OUTLINE	DIMENSIONS		
	A MAX.	Gage Minor B MAX.	Gage Major C MAX.
8-8	1.50"	.285"	.385"
8-9	1.25"	.285"	.385"
†8-10	1.50"	.285"	.410"
†8-11	1.25"	.285"	.410"

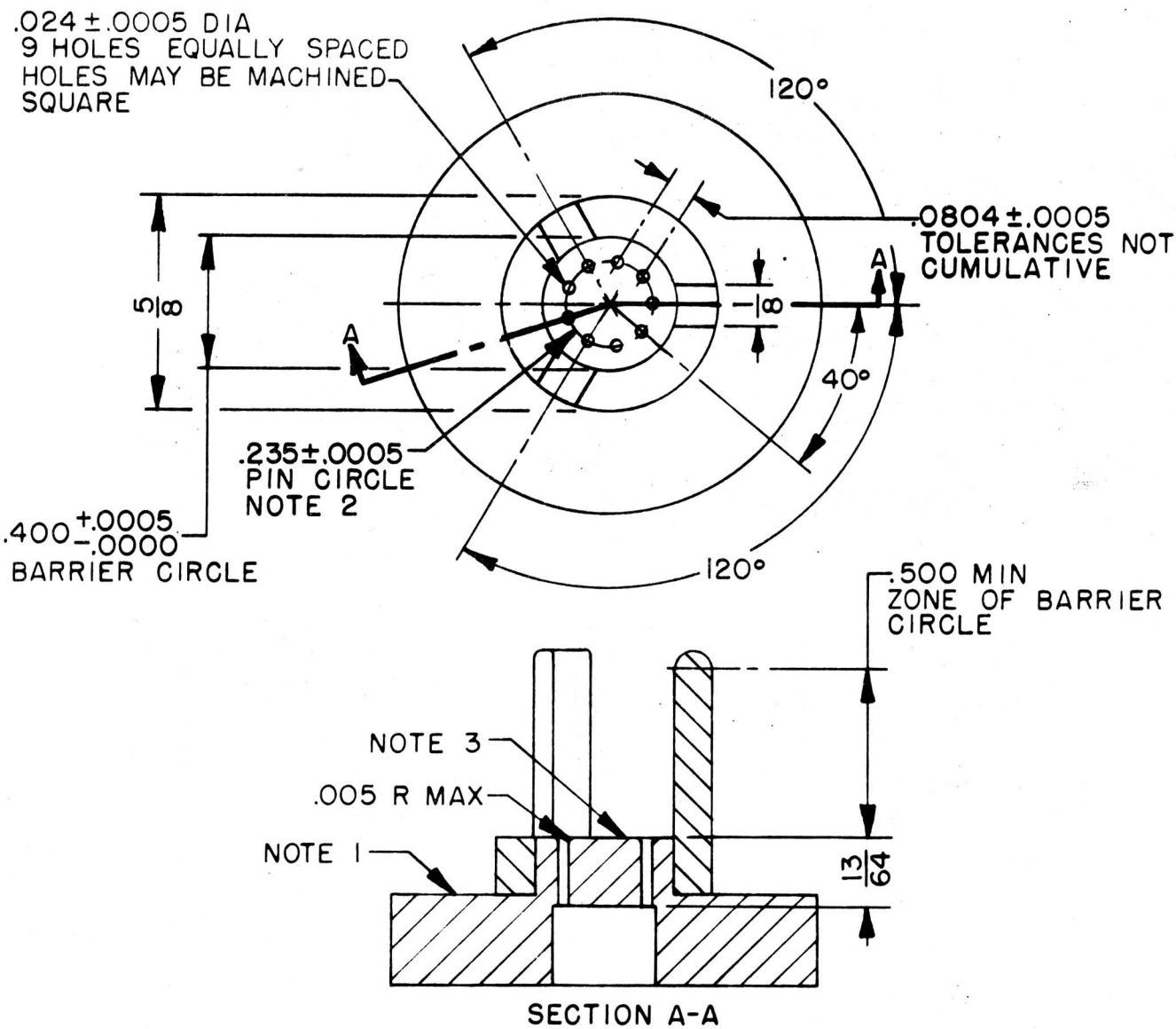
† For 7-Lead Types or others with leads in No. 1 and No. 7 positions.

Standard procedure for gaging T-2 x 3 outline dimensions:

The tube shall fit in the gage without undue force. The bulb shall lie completely within the enclosure as determined with slider.

7.3 T-3 Base Gage

GE8-1
SUBMINIATURE



Note 1. Mounting method is optional.

Note 2. Eccentricity of pin circle with respect to barrier I.D. must not exceed .0025".

Note 3. Pin circle diameter, pin spacing, pin hole diameter and tolerances apply to upper surface.

Note 4. The entire length of the pins shall, without undue force, pass into and disengage from the gage.