

MIL-S-9372C(USAF)
12 January 1960
Superseding
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MILITARY SPECIFICATION

SHIELD, ELECTRON TUBE, HEAT DISSIPATING

1. SCOPE

1.1 This specification covers the requirements for heat dissipating electron tube shields, bases, and adapters. (See 6.1.)

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on the date of invitation for bids, form a part of this specification:

SPECIFICATIONS

Federal

PPP-B-566	Boxes, Folding, Paperboard
PPP-B-585	Boxes, Wood, Wirebound
PPP-B-591	Boxes, Fiberboard, Wood-Cleated
PPP-B-601	Boxes, Wood, Cleated-Flywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-B-636	Boxes, Fiber
PPP-B-676	Boxes, Set-Up, Paperboard
PPP-T-60	Tape, Pressure Sensitive Adhesive, Water-proof—For Packaging and Sealing

Military

MIL-E-1	Electron Tubes and Crystal Rectifiers
MIL-P-116	Preservation, Methods of
MIL-B-4229	Boxes, Paperboard, Metal-Stayed
MIL-B-10377	Box, Wood, Cleated, Veneer, Paper Overlaid
MIL-L-10547	Liners, Case, Waterproof

Standards

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-202	Test Methods for Electronic and Electric Component Parts

FSC 5960

(Copies of documents required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Qualification.- The shields furnished under this specification shall be a product which has been tested and has passed the qualification tests herein.

3.2 Military Standard For Individual Shield Types.- Detail requirements shall be as specified on the individual MS sheets. In the event of conflict between requirements of this specification and requirements of the Military Standards, the latter shall govern.

3.3 Materials.- The material for each part shall be as specified. When a definite material is not specified, a material shall be used which will meet the performance requirements of this specification. Non-magnetic material shall be used. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

3.3.1 Corrosion Resistance.- The shield shall be of corrosion-resistant materials or treated to prevent corrosion formation.

3.4 Design and Construction.- The shield or liner shall make good physical contact with the electron tube envelope and shall provide a good thermal conduction from the envelope to heat sink.

3.4.1 Finish.- The finish of the shield shall be such that there will be no evidence of peeling, cracking, or corrosion before or following the environmental tests specified herein.

3.4.2 Installation and Removal.- Design of the shield shall be such that installation or removal of the shield from a seated electron tube will not scratch the electron tube envelope. Except as otherwise specified, no tool shall be required for installation or removal of the shield from the base. No part of the shield shall exceed the dimensions specified on the applicable standard.

3.4.3 Spring Retention.- The coil spring shall be held in place by friction, or mechanical means if the maximum outside diameter of the spring is smaller than the inside diameter of the shield. The free end of the spring, or the loop that makes contact with the electron tube envelope shall be at least seven-eighths of a complete turn and shall be smoothly rounded.

3.5 Performance

3.5.1 Cooling.- The average reduction of surface temperature of the slug shall not be less than 20°C when tested in accordance with 4.4.2 and 4.4.3. (See also table I of figure 1.)

3.5.2 Vibration.- The shield shall not loosen from the shield base, and there shall be no evidence of damage to the shield or glass envelope of the electron tube when tested in accordance with 4.4.4.

3.5.3 Installation Force

3.5.3.1 Installation Force at 25°C.- The force necessary to install the shield over the maximum diameter slug in table II, figure 1, shall not be greater than specified in the applicable Military Standard. (See also 4.4.5.)

3.5.3.1.1 Installation Force at Temperature Extremes.- When tested in accordance with 4.4.7, the installation force shall not be greater than 150 percent nor less than 50 percent of the initial installation force.

3.5.4 Torque.- The torque necessary to engage the shield to the base shall not be greater than that specified in the applicable Military Standard. (See also 4.4.6.)

3.5.5 Fatigue Test.- When tested in accordance with 4.4.8, the installation force shall not be greater than 125 percent, nor less than 50 percent of the initial installation force.

3.5.6 Salt Spray.- When tested as specified in 4.4.9, the shield and mounting base finish shall not peel, blister, pit, chip, or corrode.

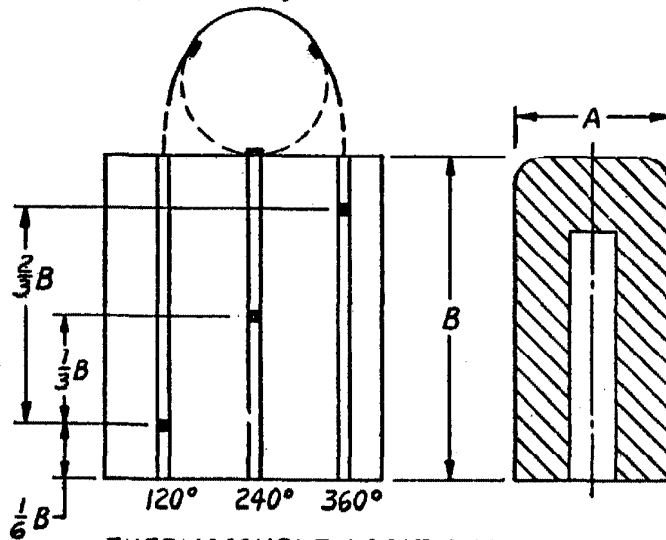
3.5.7 Heat Resistance.- There shall be no peeling, blistering, chipping, or pitting following tests specified in 4.4.10.

3.5.8 Electrical Contact.- The dc resistance from the shield to the chassis or from shield liner to chassis, when applicable, shall not be greater than 1 ohm when tested in accordance with 4.4.11.

3.6 Marking.- The shields and adapters shall be marked for identification in accordance with MIL-STD-130. The marking shall include the manufacturer's name or symbol and the applicable MS part number.

3.7 Certification of Finishes.- A certification that the finish used on the shields, adapters or bases is in accordance with the applicable Military Standard shall be furnished with each contract or order. (See 6.2.)

SLUG DIMENSIONS FOR COOLING TEST
(SEE PARA. 4.4.2)



THERMOCOUPLE LOCATIONS
PARA. 4.4.2.2

SLUG

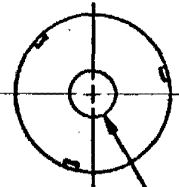
MATERIAL: 6061-T6 ALUMINUM

*TUBE STYLE	A ±.001	B ±.010
T5 1/2	.730	1.125
		1.500
		2.000
T6 1/2	.840	1.125
		1.562
		2.000
		2.437
T9	1.150	1.750
		3.250
T11	1.410	2.937
		4.062
T12	1.560	2.375
		4.750
T14	1.830	4.812
T16	2.050	4.187

TABLE II

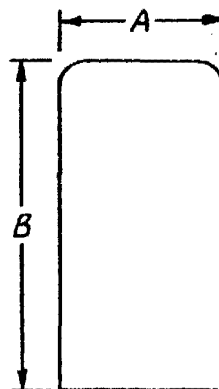
TUBE STYLE	A ±.005	B ±.010
* T5 1/2	.700	1.125
		1.500
		2.000
* T6 1/2	.800	1.125
		1.562
		2.000
		2.437
* T9	1.090	1.750
		3.250
T11	1.340	2.937
		4.062
T12	1.470	2.375
		4.750
T14	1.740	4.812
T16	1.960	4.187

TABLE I



HOLE FOR
HEATING ELEMENT

SLUG DIMENSIONS FOR INSTALLATION FORCE
TEST (SEE PARA. 3.5.3)



MATERIAL: TOOL STEEL,
HARDENED TO
60-61C, ✓

FINISH: HARD CHROME PLATE

* DESCRIBED IN MIL-E-1
BULB OUTLINES.

DIMENSIONS IN INCHES.

3.8 Certification of Materials.- A certification that the materials used in or within the construction of the shields, adapters, or bases is in accordance with the applicable Military Standard shall be furnished with each contract or order. (See 6.2.)

3.9 Inserts.- The use of corrugated inserts shall not be used without prior approval of the procuring activity.

3.10 Workmanship.- Shields shall be manufactured and processed in a careful and workmanlike manner in accordance with good design and sound practice.

4. QUALITY ASSURANCE PROVISIONS

4.1 Classification of Tests.- The inspection and testing of shields shall be classified as follows:

- a. Qualification tests: (See 4.2)
- b. Acceptance tests: (See 4.3)

4.2 QUALIFICATION TESTS

4.2.1 Sampling Instructions.- Samples submitted for qualification approval shall be representative of the manufacturer's normal production. Six samples of each type shall be submitted for test. Sample shields shall be subjected to the qualification tests in table III, in the order listed. There shall be no allowable defects.

TABLE III - Qualification Tests

Examination or test	Requirement	Test
Visual and mechanical inspection	3.3, 3.4, 3.6, 3.10	4.4.1
Installation force at 25°C	3.5.3.1	4.4.5
Installation force at temperature extremes	3.5.3.1.1	4.4.7
Torque	3.5.4	4.4.6
Fatigue test	3.5.5	4.4.8
Vibration	3.5.2	4.4.4
Heat resistance	3.5.7	4.4.10
Cooling	3.5.1	4.4.2, 4.4.3
Salt spray	3.5.6	4.4.9
Electrical contact	3.5.8	4.4.11

4.3 Acceptance Tests.- Acceptance tests shall be performed by the contractor under the supervision of the Government.

4.3.1 Group A Tests.- One shield from each lot of 1500 shields shall be subjected to the tests of table IV, in the order listed.

4.3.1.1 Rejection.- When one or more items from a lot fail the specified tests, this is a cause for rejection of the lot. Before resubmitting the lot, the contractor shall fully explain to the inspector both the corrections made and the cause of previous rejections.

TABLE IV - Acceptance Tests

Group	Examination or test	Requirement	Test
A	Visual and mechanical inspection	3.3, 3.4, 3.6, 3.10	4.4.1
	Certification of finishes	3.7	- - -
	Certification of materials	3.8	- - -
B	Salt spray	3.5.6	4.4.9
	Electrical contact	3.5.8	4.4.11

4.3.2 Group B Tests.- One shield from each lot of 1500 shields shall be subjected to the tests specified in table IV, in the order listed.

4.3.2.1 Rejection.- When one or more items from a lot fail the specified tests, this is a cause for rejection of the lot. Before resubmitting the lot, the contractor shall fully explain to the inspector both the corrections made and the cause of previous rejections.

4.4 Test Procedures

4.4.1 Visual and Mechanical Inspection.- Shields shall be inspected to verify that the materials, design, construction, physical dimensions, marking and workmanship are in accordance with the applicable requirements.

4.4.2 Cooling

4.4.2.1 Slug.- Use slug in the form and of material as shown in figure 1.

4.4.2.2 Thermocouples.- Make three grooves or slots on the surface of the slug, running from top to bottom and parallel to the axis of the slug. These grooves shall be spaced at 120° intervals around the circumference of the slug and shall be cut to a depth slightly over the diameter of the thermocouple wire. A 36 or higher gauge thermocouple shall be placed in each groove and cemented into place with a suitable cement. Care should be exercised to keep the surface of the slug smooth. Thermocouple connections shall be placed as shown in figure 1.

4.4.2.3 Heating Element.- A heating element shall be inserted in a hole drilled as shown in figure 1. The heating element shall be capable of heating the bare slug to a surface temperature of between 170° and 180°C.

4.4.2.4 Mounting.- The slug shall be mounted in the center of an 18 gauge aluminum chassis 4 inches long, 3 inches wide and 2 inches deep. The slug may be mounted on a tube socket, but shall have adequate thermal insulation from the chassis.

4.4.2.5 Cooling Measurements.- The measurements shall be made at a room temperature of 25°C $\pm$ 5°C and with no draft on the slug with the heating element adjusted so that the surface temperature, as measured by the thermocouples, is stabilized between 170°C and 180°C. Mount the shield assembly including the base. Record the stabilized surface temperature of the slug with the shield mounted. Rotate the shield at least three times with each rotation not less than 90°, nor greater than 120°. Repeat measurement for each increment of rotation.

4.4.3 Reduced Pressure.- Repeat 4.4.2 in an atmospheric pressure of 3.44 inches of mercury. The temperature measurements shall comply with 3.5.1.

4.4.4 Vibration.- The shields shall be rigidly mounted by their normal mounting means on a vibration test apparatus. With some pentode electron tube of proper envelope dimensions mounted in the shield assembly, vibrate shield in accordance with MIL-STD-202, method 204, condition b, except only six cycles shall be performed.

4.4.5 Installation Force Test at 25°C.- The force necessary to place the shield over the maximum diameter slug shall be measured at 25°C $\pm$ 5°C. (See figure 1.)

4.4.6 Locking Torque Test.- When a mounting base is a part of the shield assembly the tube shall be mounted and the force necessary to lock the shield into the base shall be measured.

4.4.7 Installation Force at Temperature Extremes.- The maximum diameter slug referred to in table II, figure 1, the shield, and mounting base shall be conditioned at 85°C $\pm$ 5°C for 2 hours after which the test described in 4.4.5 shall be performed. After completion of the 85°C test, the slug, shield, and mounting base shall then be conditioned at -55°C $\pm$ 5°C for 2 hours after which the tests described in 4.4.5 shall be repeated.

4.4.8 Fatigue Test.- After the shield is properly installed and removed from the slug 100 times, the tests described in 4.4.5 shall again be performed. (See figure 1.)

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4.4.9 Salt Spray Test.- The shield shall be submitted to a salt spray test in accordance with method 101 of MIL-STD-202, condition B. After the test, the shield shall be examined for corrosion or other physical defects as specified in 3.5.6.

4.4.10 Heat Resistance.- Subject shields to an ambient temperature of 200°C $\pm$ 5°C for 48 hours. One hour after removal from the oven, examine the finish of the shields for defects.

4.4.11 Electrical Contact Test.- This test shall be performed using any standard ohm-meter of an accuracy of $\pm$ 3 percent, or better. (See 6.4.)

5. PREPARATION FOR DELIVERY

5.1 Preservation and Packaging (See 6.2.)

5.1.1 Level A.- Shields or retainers shall be individually protected and unit-packaged in accordance with method 1A of MIL-P-116, without the use of contact preservatives. Five unit packages or a multiple thereof shall be further packaged in intermediate containers conforming to PPP-B-566, PPP-B-676, or MIL-B-4229. The gross weight of the intermediate container shall not exceed 10 pounds.

5.1.2 Level C.- Shields or retainers shall be afforded preservation and packaging in accordance with the manufacturer's normal commercial practice.

5.2 Packing (See 6.2.)

5.2.1 Level A.- Shields and retainers packaged as specified shall be packed in overseas-type wirebound wood, wood-cleated fiberboard, wood-cleated plywood, nailed wood, fiber (class 2 or 3, as specified (see 6.2.)) or wood-cleated paper-overlaid boxes conforming to PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-621, PPP-B-636, and MIL-B-10377, respectively, at the option of the manufacturer. Shipping containers shall have case liners conforming to MIL-L-10547; the case liners shall be closed and sealed in accordance with the appendix thereto. Case liners for boxes conforming to PPP-B-636 may be omitted provided the center and edge seams and manufacturer's joints are sealed with tape, at least 1-1/2 inches wide, conforming to type III, class 1, of PPP-T-60. Box closure and strapping shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification. (See 6.2.)

5.2.2 Level B.- Shields and retainers packaged as specified shall be packed in domestic-type wirebound wood, wood-cleated fiberboard, wood-cleated plywood, nailed wood, fiber, or wood-cleated paper-overlaid boxes conforming to PPF-B-585, PPF-B-591, PPF-B-601, PPF-B-621, PPF-B-636, and MIL-B-10377, respectively, at the option of the manufacturer. Box closures shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.3 Level C.- Shields and retainers packaged as specified shall be packed in containers of the type, size, and kind commonly used for the purpose, in a manner that will insure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with the Consolidated Freight Classification Rules, or regulations of other carriers as applicable to the mode of transportation.

Insofar as possible and practical, exterior containers shall be uniform in shape and size, and shall be of minimum cube and tare consistent with the protection required, and shall contain identical quantities of identical items.

5.3 Marking.- In addition to any special marking required by the contract or order, unit packages, intermediate packages, and exterior shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended Use.- Electron tube shields are for use to provide electrostatic shielding and retention under shock and vibration, in addition to lowering bulb operating temperature.

6.2 Ordering Data.- Procurement documents should specify the following:

- a. Title, number, and date of this specification.
- b. Stock number.
- c. Level of packaging, packing, and marking required.
- d. Disposition of certificate for materials and finishes. (See 3.7 and 3.8.)

6.3 Disposition of Samples.- Samples subjected to Group B tests will not be delivered on the contract or order.

6.4 Electrical Contact Assurance.-- Care should be exercised when determining the dc resistance between the upper shield and its mounting base. The mounting base should be securely bolted to an unpainted chassis and the finish of the upper shield should be scraped or sanded to assure a bare metallic contact. (See 3.5.8.)

6.5 Qualification.-- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is Commander, Wright Air Development Center, ATTN: WCLKCP, Wright-Patterson Air Force Base, Ohio.

NOTICE. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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