Multiplier Phototube

RUGGED VIBRATION-RESISTANT STRUCTURE
S-11 RESPONSE — ELECTROSTATICALLY FOCUSED
10-STAGE, HEAD-ON, FLAT-FACEPLATE TYPE — DYNODE STAGES

For Detection and Measurement of Nuclear Radiation and other Low-Level Light Sources. Especially Useful in Missile and Rocket Service and other Industrial and Military Applications where Severe Environmental Conditions may be Encountered.

The 4441A is the same as the 4441 except for the following:

Characteristics Range Values for Equipment Design:

With E = 1000 volts

	Min.	*Typ.*	*Max.*	
Anode-Pulse Rise Time[a]	–	2.8×10^{-9}	–	sec.
With E = 750 volts				
Equivalent Anode-Dark-Current Input at a luminous sensitivity of 20 a/lm[b,c]	–	8×10^{-10}	2.5×10^{-9}	lm

ENVIRONMENTAL TESTS:

The 4441A is designed to withstand environmental tests equivalent to those specified in MIL-E-5272C* for equipment mounted on the structures of missiles propelled or launched by high-thrust rocket engines. The accelerations specified in these tests are applied directly to the tubes.

One-Hundred Per-Cent Shock and Vibration Testing:

Shock. These tests are performed first, per method of MIL-E-5272C*, Par.4.15.5.1, Proc.V, on apparatus which provides a half-wave sinusoidal shock pulse. One-hundred per-cent testing of all 4441A's is performed. Each 4441A (non-operating) is subjected to three impact shocks in each direction of the three orthogonal axes. Each impact shock has a peak acceleration of 30 ± 3 g's and a time duration of 11 ± 1 milliseconds. Each tube is subjected to a total of 18 impact shocks.

Vibration. These tests are performed next, on apparatus which applies a variable-sinusoidal frequency vibration to the tube in accordance with MIL-E-5272C*, par.4.7.14 and par.4.7.14.1, except for the cycle duration. This test is performed on all 4441A tube types. Each 4441A (Operating under the conditions specified under *Tube Rejection Criterion*) is vibrated in each of the three orthogonal axes and as specified in the following schedule. A vibration cycle has a duration of 5 minutes per axis in which time the frequency is varied logarithmically from 20 to 2000 and back to 20 cycles per second. One vibration cycle is performed for each axis and the total test period for each tube is 15 minutes.

Double Amplitude inches	Acceleration g's	Frequency cps	Cycle Duration Per Axis minutes
0.050 ± 0.005	–	20–87	5
–	20	87–2000	
–	20	2000–87	
0.050 ± 0.005	–	87–20	

Tube Rejection Criterion. After completion of the shock tests, tubes are operated at an anode-to-cathode voltage of 1000 volts with the light level incident on the tube adjusted to provide an anode current of 8 microamperes. Electrical and/or mechanical tube failures due to shock or vibration are observed during the vibration test when the specified anode current is monitored. Tube rejection criterion for both tests is that the anode current of 8 microamperes will not change more than ± 20 per cent at any time during the vibration test for each axis.

Design Tests:

Vibration. These tests are performed under conditions equivalent to those described in MIL-E-5272C*, par.4.7.14 and par.4.7.14.1. The vibration cycle has a duration of one hour and two cycles are performed for each of the three orthogonal axes. The total test period for each tube is six hours.

Acceleration. These tests are performed in a centrifuge providing unidirectional acceleration by a method equivalent to that specified in MIL-E-5272C*, par.4.16.3, Proc.III except that tubes are subjected for one minute to an increased acceleration test level of 100 ± 10 g's in both directions of the three orthogonal axes and the tubes are non-operating.

* Military Specification MIL-E-5272C (ASG), 13 April 1959; and Amendment 1, 5 January 1960.